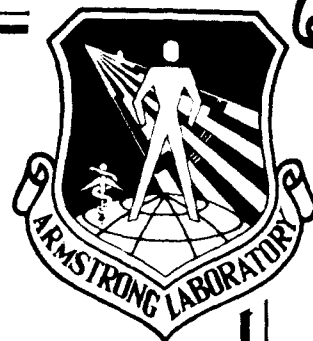AL-TR-1992-0036

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USER'S GUIDE TO THE ANTHROPOMETRIC DATABASE AT THE COMPUTERIZED ANTHROPOMETRIC RESEARCH AND DESIGN (CARD) LABORATORY (U)
Second Edition

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AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6573

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TECHNICAL REVIEW AND APPROVAL

AL-TR-1992-0036

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

KENNETH R. BOFF, Chief
Human Engineering Division
Armstrong Laboratory

REPORT DOCUMENTATION PAGE

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The Anthropometric Database at the Computerized Anthropometric Research and Design (CARD) Laboratory contains hundreds of measurements from numerous Anthropometric surveys. As new data collections are received, they are integrated into the database. The entire collection is managed using a computerized database system which allows the user to access data using a menu-driven system. Data may be accessed using a variety of sort criteria for each survey. Users also have the option of using statistical techniques to analyze the data. This document is a guide to users for accessing this information.

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SUMMARY

This document is designed to assist users in accessing the Anthropometric Database maintained by the Computerized Anthropometric Research and Design (CARD) Laboratory. The on-line database was developed to be used in support of human engineering design activities. It contains several hundred measurements of the human body obtained from large population samples and documented in numerous published anthropometric surveys. A relational database software package is used to manage the survey data and accommodate user queries. Access to the database is through a menu-driven applications software package. The user may access anthropometric data by measurement title, measurement number, or by common alternate measurement name. Available data includes measurement frequency data and summary statistics (means, standard deviations, etc.), measurement descriptions, and measurement classifications by body region and measurement type. A glossary of anthropometric terms is available in the database as well as abstracts describing the various anthropometric surveys. analysis using the statistical package SAS. The option to perform multivariate analysis using survey data is also available to these users.

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PREFACE

TABLE OF CONTENTS

USER'S GUIDE TO THE
ANTHROPOMETRIC DATABASE AT THE
COMPUTERIZED ANTHROPOMETRIC RESEARCH
AND DESIGN (CARD) LABORATORY

1. INTRODUCTION

The Computerized Anthropometric Research and Design (CARD) laboratory is operated by AL/CFHD at Wright-Patterson AFB, Ohio. The CARD Anthropometric Database contains data collected from a variety of anthropometric surveys. Access to the database is through menu-driven applications software. Data available include survey descriptions, measurement methods, and a glossary of anthropometric terms, as well as summary statistics and frequency data for each measurement. The ability to extract measurement data meeting specific criteria from a survey and using these data as input to a SAS procedure is also available to users with special permission granted by AL/CFHD. A multivariate analysis package is also available to users with special access privileges.

2. GUIDELINES FOR DATABASE USE

All terminals used to access the menu-driven database software must be at least VT100 compatible to support the drawing of the menu displays. Menu options may be selected by using the up or down arrow keys or by pressing the keyboard letter of the selection requested.

Each anthropometric measurement in the database has an assigned number and measurement title. There is a standard table of abbreviations which will be displayed when measurement title input is requested. Measurement titles containing more than one word are separated by dashes (-), not spaces. For example, SITTING HT must be entered as SITTING-HT.

An alternate measurement name table contains common alternate names for measurements. For example, STATURE has an entry in the alternate name table called HEIGHT. Searches for character strings in measurement titles are also available in some menus. This is convenient when the measurement title and number are unknown and the user would like to scan the database to pin down the actual measurement being sought. Specific measurement data may be accessed using the measurement number, measurement title, or alternate name.

3. EXECUTION OF THE DATABASE PROGRAM

3.1 PROGRAM EXECUTION BY FALCON VAX USERS

The program is executed by authorized users logged into their FALCON VAX accounts by entering **QUERY**.

3.2 PROGRAM EXECUTION BY NON-FALCON VAX USERS

The account ANTHRO has been set up to accommodate those users of the database who do not have FALCON VAX accounts. The QUERY software executes automatically and the user is logged out after exiting the QUERY software. The distribution of the account name and password is made at the discretion of AL/CFHD.

4. COMMUNICATIONS INFORMATION

The Armstrong Lab FALCON VAX may be accessed by telephone modem or by using the Defense Data Network (DDN). A DEC VT type terminal (VT1xx,VT2xx, etc.) or an emulator of these terminals is required to execute the database software. Terminals must have the following communication characteristics:

- Parity - None

- Eight Bits, 1 Stop Bit

- No Local Echo

- Transmit Speed - < 300, 1200, or 2400 baud >

4.1 ACCESS USING A TELEPHONE MODEM

Users may communicate with the FALCON VAX at 300, 1200, or 2400 baud. The phone number for the 300/1200 baud lines is 513-255-8827 (Autovon 785-8827). The three numbers for the 2400 baud lines are 513-255-8838 (Autovon 785-8838), 513-255-8839 (Autovon 785-8839), and 513-255-8840 (Autovon 785-8840).

4.2 ACCESS USING THE DEFENSE DATA NETWORK (DDN)

Users may also communicate using the DDN. The host address and name for FALCON is 129.48.134.10 FALCON.AAMRL.WPAFB.AF.MIL. Users coming in over the network may use TELNET to connect to the FALCON VAX. The account ANTHRO and the designated password must then be entered to access the database.

5. DATABASE ACCESS LEVELS

Access into the database is granted at two levels. Level one and two users may access the General Analysis Package in the anthropometric database. This includes measurement summary statistics, measurement classification and anthropometric definitions. Level two users are also allowed to perform data analysis on survey populations using the statistical analysis package SAS. A Multivariate Analysis Package is also available to level two users. Level of access granted is determined by AL/CFHD.

6. SIGN-ON PROCEDURE

The first screen requests input of a database code name and password. Each individual allowed access is assigned a code name and password by AL/CFHD which allows for monitoring of database access and use. After the database code name is entered, the user is prompted for a password. When the password is entered, it will not echo back to the screen for security reasons.

**WELCOME TO THE
ARMSTRONG LABORATORY
ANTHROPOMETRIC DATABASE**

DATABASE CODE NAME: JDOE

DATABASE PASSWORD:

**When exiting the database, select X from the main menu
and wait until you receive the "ANTHRO System finished"
and the DSS::DISCONNECTED message.**

When level-two access has been granted, the user is given the option of using the General Analysis Package or the Multivariate Analysis package. Users with level-one access will bypass this screen and begin executing the General Analysis package.

ANTHROPOMETRIC DATA ANALYSIS

(A) GENERAL ANALYSIS PACKAGE

(B) MULTIVARIATE ANALYSIS PACKAGE

(X) EXIT PROGRAM

---

7. <u>GENERAL ANALYSIS PACKAGE</u>

The first screen in the General Analysis Package indicates the initialization of the database and the pre-processing of selected anthropometric data. This procedure takes approximately 25-30 seconds.

The following screens display introductory messages to the anthropometric database. A carriage return entered from the keyboard will advance to the next page.

Loading Database files...Please wait

WELCOME TO THE
ARMSTRONG LABORATORY
ANTHROPOMETRIC DATABASE

This database is a product of the Computerized
Anthropometric Research and Design (CARD) Laboratory
which is operated and maintained by AL/CFHD at
Wright-Patterson AFB, Ohio. It is a menu-driven
database which will allow you to access anthropometric data from a
collection gathered from around the world. It includes descriptive
information regarding the samples themselves, measurement
methods, summary statistics, and a glossary of terms. The
measurements are organized in many ways for ease of use.

NOTE: This database is in the process of being developed. Data from
many of the surveys listed have not yet been input. The alternate
name list is incomplete. Suggestions regarding the database
are welcome.

Press <RETURN> to continue

THE FOLLOWING CONVENTIONS
ARE USED IN THIS DATABASE

Each anthropometric measurement has an assigned name and number.
The words in the name are separated by dashes (-) not spaces,
e.g. Abdominal Depth Sit would be ABDOMINAL-DEPTH-SIT.

If you are unclear about a measurement name or number, the
measurement may be searched for by using a string of letters or by
using common alternate names.

NOTE: A HELP utility is being developed to provide help in using
the database while in the midst of it. This is not yet available.

Press <RETURN> to continue

CAUTIONS:

* Measures from two samples listed under the same name may have been measured slightly differently. Be cautious about drawing conclusions about differences or similarities between samples.

* Percentile values are not additive. For example, 5th percentile sitting height minus 5th percentile eye-height-sitting will not equal 5th percentile eye-to-top-of-head. To derive measures not listed, the raw data on each person must be used. Also, be cautious about using percentile values if more than one measure is to be used. Some type of "multivariate" method should be used in such cases.

Press <RETURN> to continue

7.1 <u>MASTER MENU</u>

The master menu for the anthropometric database general analysis package presents primary query options available to the user. The option requested is highlighted and selected by letter or by using the up and down arrow keys as input. A carriage return is entered when selection is complete. This is applicable for all menus throughout the database program.

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│              AL ANTHROPOMETRIC DATABASE                     │
│                                                             │
│      (A) LIST SURVEYS                                       │
│                                                             │
│      (B) FIND MEASUREMENTS, TITLES, AND NUMBERS             │
│                                                             │
│      (C) LIST MEASUREMENTS                                  │
│                                                             │
│      (D) GLOSSARY AND MEASUREMENT DESCRIPTIONS              │
│                                                             │
│      (E) MEASUREMENT STATISTICS                             │
│                                                             │
│      (F) MULTIVARIATE COCKPIT ACCOMMODATION MODELS          │
│                                                             │
│      (G) ATF MAINTAINER CLEARANCE VALUES                    │
│                                                             │
│      (X) EXIT PROGRAM                                       │
│                                                             │
│                                                             │
│    SELECT OPTION BY LETTER OR ARROWS AND PRESS RETURN       │
└─────────────────────────────────────────────────────────────┘
```

7.1.1 LIST SURVEYS

The option LIST SURVEYS displays survey abstracts for population data available to the user. A specific survey abstract may be selected and displayed.

```
+-----------------------------------------------------------+
|               DISPLAY SURVEY ABSTRACT                     |
|                                                           |
|         SURVEY      SURVEY TITLE                          |
|                                                           |
|     (A)    1    AF FEMALE 1968 NONRATED                   |
|     (B)    6    AF FEMALE 1968 PILOT SUBSET               |
|     (C)    2    AF MALE PILOTS 1967                       |
|     (D)    3    AF MALE 1965 NONRATED                     |
|     (E)    8    AF MALE 1965 BLACK PILOT SUBSET           |
|     (F)    4    ARMY MALE 1966                            |
|     (G)    5    ARMY FEMALE 1977                          |
|     (H)    7    ARMY MALE 1977 SUBSET                     |
|     (I)    9    NAVY AVIATORS 1964                        |
|                                                           |
|                                                           |
|     (X)    RETURN TO PREVIOUS MENU                        |
|                                                           |
+-----------------------------------------------------------+
```

1968 SURVEY OF AIR FORCE WOMEN

A survey of women of the Air Force was made in the spring of 1968 by the
Anthropology Branch, Aerospace Medical Research Laboratory, Wright-
Patterson Air Force Base, Ohio, and the Anthropology Research Project
(then at Antioch College, Yellow Springs, Ohio). A description of the
survey and the results are published in "Anthropometry of Air Force Women,"
by Clauser et al., AMRL-TR-70-5 (AD 743 113), Aerospace Medical Research
Laboratory, Wright-Patterson Air Force Base, Ohio, 1972. Data for age
(variable 1), 123 body size measurements (variables 2-124), and grip
strength (variable 125) were obtained from a sample of 1905 women.
Thirteen measurements were repeated on 1513 subjects with the subjects
wearing foundation garments (variables 126-138). These are not
included in this database because they are now obsolete. This
data is also described along with Volumes II-V of the AMRL
Anthropometric Data Bank Library in "The AMRL Anthropometric
Data Bank Library: Volumes I-V," by Churchill, Kikta, and Churchill,
AMRL-TR-77-1, Aerospace Medical Research Laboratory, Wright-Patterson Air
Force Base, Ohio, October 1977.

Press <RETURN> to continue.

7.1.2 FIND MEASUREMENTS, TITLES, AND NUMBERS

The Measurement menu presents options available for gaining access to measurement data. Items A through C serve to help the user identify the exact measurement title or number. Item D permits the user to extract the statistics for the measurement desired once the title or number is identified without having to back up to the main menu.

```
┌──────────────────────────────────────────────────────────────┐
│                                                              │
│        FIND MEASUREMENTS, TITLES, AND NUMBERS                │
│                                                              │
│                                                              │
│   (A) FIND MEASUREMENTS BY ALTERNATE NAME OR BY STRING       │
│                                                              │
│   (B) GET MEASUREMENT TITLE FROM MEASUREMENT NUMBER          │
│                                                              │
│   (C) GET SURVEYS WHERE A MEASUREMENT WAS TAKEN              │
│                                                              │
│   (D) MEASUREMENT DATA STATISTICS                            │
│                                                              │
│   (X) RETURN TO MAIN MENU                                    │
│                                                              │
│                                                              │
│       SELECT OPTION BY LETTER OR ARROWS AND PRESS RETURN     │
│                                                              │
└──────────────────────────────────────────────────────────────┘
```

FIND MEASUREMENTS BY ALTERNATE NAME OR STRING

This option allows the user to input a measurement alternate name or a string of characters to search for a measurement number and title. The software will search the database for all measurement titles and alternate names containing the input character string.

In this example the string STATURE is entered and all those measurement titles containing the string STATURE are displayed.

FIND MEASUREMENTS BY ALTERNATE NAMES OR BY STRING

STANDARD ABBREVIATIONS

BRTH	- BREADTH		HT	- HEIGHT
CIRC	- CIRCUMFERENCE		LTH	- LENGTH
DIAM	- DIAMETER		SIT	- SITTING
DIST	- DISTANCE		SKF	- SKINFOLD
EXT	- EXTENSION		STD	- STANDING

INPUT MEASUREMENT TITLE OR STRING: STATURE

```
FIND MEASUREMENTS BY ALTERNATE NAMES OR BY STRING

        NUMBER        MEASUREMENT TITLE

          805         STATURE
          806         STATURE-CLOTHED
          807         STATURE-MAXIMUM
          808         STATURE-REPORTED




        Press <RETURN> to continue
```

In the next example the string HEIGHT is entered. Since HEIGHT is an alternate name for STATURE in the database, the same entries as for STATURE are retrieved from the database and displayed.

FIND MEASUREMENTS BY ALTERNATE NAMES OR BY STRING

```
                    STANDARD ABBREVIATIONS

    BRTH  -  BREADTH              HT    -  HEIGHT
    CIRC  -  CIRCUMFERENCE        LTH   -  LENGTH
    DIAM  -  DIAMETER             SIT   -  SITTING
    DIST  -  DISTANCE             SKF   -  SKINFOLD
    EXT   -  EXTENSION            STD   -  STANDING
```

INPUT MEASUREMENT TITLE OR STRING: HEIGHT

FIND MEASUREMENTS BY ALTERNATE NAMES OR BY STRING

NUMBER	MEASUREMENT TITLE
805	STATURE
806	STATURE-CLOTHED
807	STATURE-MAXIMUM
808	STATURE-REPORTED

Press <RETURN> to continue

GET MEASUREMENT TITLE FROM MEASUREMENT NUMBER

This option requests the input of a measurement number and returns the corresponding standard measurement title from the database.

```
RETRIEVE MEASUREMENT TITLE




INPUT MEASUREMENT NUMBER:   805


MEASUREMENT TITLE:   STATURE




Press <RETURN> to continue
```

GET SURVEYS WHERE A MEASUREMENT WAS TAKEN

This option allows for input of a sp' ~ific measurement title, number, or alternate name and retrieves and displays those surveys in which the measurement was taken.

```
SURVEYS WHERE A MEASUREMENT WAS TAKEN

        STANDARD ABBREVIATIONS

BRTH  -  BREADTH              HT   -  HEIGHT
CIRC  -  CIRCUMFERENCE        LTH  -  LENGTH
DIAM  -  DIAMETER             SIT  -  SITTING
DIST  -  DISTANCE             SKF  -  SKINFOLD
EXT   -  EXTENSION            STD  -  STANDING


INPUT MEASUREMENT TITLE OR NUMBER:   805
```

SURVEYS WHERE A MEASUREMENT WAS TAKEN

MEASUREMENT NUMBER: 805
MEASUREMENT TITLE: STATURE

SURVEY   SURVEY TITLE

     1   AF FEMALE 1968 NONRATED
     2   AF MALE PILOTS 1967
     3   AF MALE 1965 NONRATED
     4   ARMY MALE 1966
     5   ARMY FEMALE 1977
     6   AF FEMALE 1968 PILOT SUBSET
     7   ARMY MALE 1977 SUBSET
     8   AF MALE 1965 BLACK PILOT SUBSET
     9   NAVY AVIATORS 1964

Press <RETURN> to continue

7.1.3 LIST MEASUREMENTS

The LIST MEASUREMENTS menu presents options available to list measurements sorted in various categories. These include listing of measurements by survey, body region, and measurement type.

LIST MEASUREMENTS OPTIONS

(A) LIST MEASUREMENTS BY SURVEY

(B) LIST MEASUREMENTS BY BODY REGION

(C) LIST MEASUREMENTS BY MEASUREMENT TYPE

(X) RETURN TO PREVIOUS MENU

LIST MEASUREMENTS BY SURVEY

This option lists active surveys in the database and allows the user to display the measurement titles and numbers of those measures taken in the selected survey. In the following example Survey 1 is selected.

LIST MEASUREMENTS IN SURVEY

	SURVEY	SURVEY TITLE
(A)	1	AF FEMALE 1968 NONRATED
(B)	6	AF FEMALE 1968 PILOT SUBSET
(C)	2	AF MALE PILOTS 1967
(D)	3	AF MALE 1965 NONRATED
(E)	8	AF MALE 1965 BLACK PILOT SUBSET
(F)	4	ARMY MALE 1966
(G)	5	ARMY FEMALE 1977
(H)	7	ARMY MALE 1977 SUBSET
(I)	9	NAVY AVIATORS 1964

(X)   RETURN TO PREVIOUS MENU

```
                MEASUREMENTS TAKEN IN SURVEY

        SURVEY NAME:   AF FEMALE 1968 NONRATED

          NUMBER           MEASUREMENT TITLE

            8             ABDOMINAL-EXT-CIRC
           10             ABDOMINAL-EXT-DEPTH
           18             ABDOMINAL-EXT-HT
           23             ACROMION-HT
           39             ACROMION-RADIALE-LTH
           48             AGE
           58             ANKLE-CIRC
           64             ANKLE-HT
           70             ARM-CIRC-AXILLARY
           72             ARM-CIRC-BICEPS-RELAXED
           73             ARM-CIRC-BICEPS-RELAXED-LEFT
           77             ARM-CIRC-BICEPS-FLEXED


        Press RETURN to continue, "S" to stop
```

LIST MEASUREMENTS BY BODY REGION

Each measurement in the database has been classified by body region. This option lists the body region classifications and allows the user to display measurement titles and numbers by body region. This is helpful when trying to determine which measurements are available for a given region in the body. An example from the whole body category is shown.

LIST MEASUREMENTS BY BODY REGION

	REGION #	BODY REGION
(A)	1	WHOLE BODY
(B)	2	HEAD & NECK
(C)	3	TORSO
(D)	4	ARM (TOTAL)
(E)	5	UPPER ARM
(F)	6	FOREARM
(G)	7	HAND
(H)	8	LEG (TOTAL)
(I)	9	THIGH
(J)	10	CALF (LOWER LEG)
(K)	11	FOOT
(L)	12	MISCELLANEOUS

(X)   RETURN TO PREVIOUS MENU

MEASUREMENTS IN BODY REGION

BODY REGION: WHOLE BODY

NUMBER	MEASUREMENT TITLE
167	BODY-LTH-SUPINE-KNEES-FLEXED
169	BOWED-TORSO-HT
405	GRIP-REACH-OVERHEAD
538	KNEELING-HT
654	OVERHEAD-REACH-SIT
655	OVERHEAD-REACH-FORWARD
758	SITTING-HT
760	SITTING-HT-RELAXED
805	STATURE
806	STATURE-CLOTHED
807	STATURE-MAXIMUM

Press RETURN to continue, "S" to stop

LIST MEASUREMENTS BY TYPE

Each measurement in the database has been classified by measurement type. Circumferences, arcs, heights, etc. have been grouped together. This option lists the measurement type classifications and allows the user to display the measurement titles and numbers in each class. An example from the arcs category is shown.

LIST MEASUREMENTS BY MEASUREMENT TYPE

	TYPE #	TYPE DESCRIPTION
(A)	1	ARCS
(B)	2	BREADTHS
(C)	3	CIRCUMFERENCES
(D)	4	DEPTHS
(E)	5	DISTANCES
(F)	6	HEIGHTS
(G)	7	LENGTHS
(H)	8	REACHES
(I)	9	SEATED
(J)	10	SKIN-FOLDS
(K)	11	MISCELLANEOUS
(L)	12	CODED VARIABLES
(M)	13	STRENGTHS

(X)   RETURN TO PREVIOUS MENU

LIST BY MEASUREMENT TYPE

MEASUREMENT TYPE: ARCS

NUMBER	MEASUREMENT TITLE
93	BACK-ARC-AT-BUST
95	BACK-ARC-AT-WAIST
144	BITRAGION-CORONAL-ARC
150	BITRAGION-MENTON-ARC
152	BITRAGION-MINIMUM-FRONTAL-ARC
154	BITRAGION-NUCHALE-ARC
156	BITRAGION-SUBMANDIBULAR-ARC
158	BITRAGION-SUBNASALE-ARC
185	BUTTOCK-CURVATURE
269	DELTOID-ARC
616	MINIMUM-FRONTAL-ARC
702	SAGITTAL-ARC-INION

Press RETURN to continue, "S" to stop

7.1.4 <u>GLOSSARY AND MEASUREMENT DESCRIPTIONS</u>

The Glossary menu presents options which provide the user with descriptive and informative data including anthropometric terms and measurement descriptions available from the database.

GLOSSARY AND MEASUREMENT DESCRIPTIONS

(A) LIST ALL TERMS IN GLOSSARY

(B) STRING SEARCH FOR TERM IN GLOSSARY

(C) LOOK UP TERM IN GLOSSARY

(D) MEASUREMENT DESCRIPTIONS

(E) CODED VARIABLE DESCRIPTIONS

(X) RETURN TO MAIN MENU

LIST ALL TERMS IN GLOSSARY

This option provides the user with a list of all the terms available in the anthropometric term glossary.

ANTHROPOMETRIC TERMS

ABDOMINAL
ABDOMINAL-EXTENSION-LEVEL
ABDUCT
ACROMIAL
ACROMIALE
ACROMION
ADDUCT
ANTERIOR
ANTERIOR-SUPERIOR-ILIAC-SPINE
ANTERO
ANTHROPOMETRY
ARM
AURICLE
AURICULAR
AXILLA

Press RETURN to continue, "S" to stop

STRING SEARCH FOR TERM IN GLOSSARY

This option allows the user to input a character string and display all those terms in the anthropometric glossary which contain the string.

<div style="border: 1px solid black; padding: 20px;">

STRING SEARCH FOR TERM IN GLOSSARY

INPUT TERM SEARCH STRING: ACROM

</div>

STRING SEARCH FOR TERM IN GLOSSARY

ACROMIAL
ACROMIALE
ACROMION

Press <RETURN> to continue

LOOK UP TERM IN GLOSSARY

This option displays the definition of a requested anthropometric term from the glossary.

LOOK UP TERM IN GLOSSARY

INPUT ANTHROPOMETRIC TERM: ACROMIALE

ANTHROPOMETRIC TERM DEFINITION

TERM: ACROMIALE

LANDMARK TITLE FOR THE MOST LATERAL POINT ON THE
ACROMIAL PROCESS OF THE SCAPULA (SHOULDER BLADE).
FREQUENTLY INTERCHANGEABLE WITH ACROMION.

Press <RETURN> to continue

MEASUREMENT DESCRIPTIONS

Each measurement title has an entry in the database which describes how the measurement was taken. The description may be requested by measurement number, title, or alternate name.

MEASUREMENT DESCRIPTIONS

STANDARD ABBREVIATIONS

BRTH	- BREADTH	HT	- HEIGHT
CIRC	- CIRCUMFERENCE	LTH	- LENGTH
DIAM	- DIAMETER	SIT	- SITTING
DIST	- DISTANCE	SKF	- SKINFOLD
EXT	- EXTENSION	STD	- STANDING

INPUT MEASUREMENT TITLE OR NUMBER: STATURE

```
+-------------------------------------------------------------+
|                                                             |
|             MEASUREMENT DESCRIPTION                         |
|                                                             |
|                                                             |
|   MEASUREMENT TITLE:  STATURE                               |
|                                                             |
|                                                             |
|   SUBJECT STANDS ERECT, HEAD IN THE FRANKFORT PLANE,        |
|   HEELS TOGETHER, AND WEIGHT DISTRIBUTED EQUALLY ON BOTH    |
|   FEET - THE DISTANCE FROM THE FLOOR TO THE TOP OF          |
|   THE HEAD.                                                 |
|                                                             |
|                                                             |
|                                                             |
|                                                             |
|       Press <RETURN> to continue                           |
|                                                             |
+-------------------------------------------------------------+
```

CODED VARIABLE DESCRIPTIONS

Many variables in the database have been entered using codes. Numbers have been assigned for certain categories of data. This option allows the user to request data by number, title, or alternate name. The codes and their corresponding descriptions will be displayed.

CODED VARIABLE DESCRIPTIONS

STANDARD ABBREVIATIONS

BRTH	- BREADTH	HT	- HEIGHT
CIRC	- CIRCUMFERENCE	LTH	- LENGTH
DIAM	- DIAMETER	SIT	- SITTING
DIST	- DISTANCE	SKF	- SKINFOLD
EXT	- EXTENSION	STD	- STANDING

INPUT MEASUREMENT TITLE OR NUMBER: BLOOD-TYPE

```
CODED VARIABLE DESCRIPTIONS

MEASUREMENT NUMBER:        1003
MEASUREMENT TITLE:        BLOOD-TYPE

CODE          CODE DESCRIPTION

  1.          A
  2.          B
  3.          AB
  4.          O




Press <RETURN> to continue
```

7.1.5 <u>MEASUREMENT STATISTICS</u>

   The Measurement Data Statistics menu presents options available to re-
trieve statistical data for a measurement by survey. This menu only appears
if a user has level-two authorization from AL/CFHD to execute SAS pro-
cedures. Level-one users will automatically execute the summary statistics
option.

MEASUREMENT DATA STATISTICS

(A) MEASUREMENT STATISTICS FOR INDIVIDUAL SURVEYS

(B) MEASUREMENT STATISTICS ACROSS ALL SURVEYS

(C) BUILD SAS DATA SET

(X) RETURN TO PREVIOUS MENU

MEASUREMENT STATISTICS FOR INDIVIDUAL SURVEYS OPTIONS

The Measurement Statistics menu allows the user the option to retrieve measurement summary statistics or to enter a measurement value to retrieve the approximate percentile of that measurement in a specified survey.

MEASUREMENT STATISTICS OPTIONS

(A) MEASUREMENT SUMMARY STATISTICS

(B) PERCENTILE VALUE QUERY

(X) RETURN TO PREVIOUS MENU

MEASUREMENT SUMMARY STATISTICS

Summary statistics for each measurement by survey have been computed and entered into the database. Univariate statistics and frequency data for each measurement is available. The summary statistics for each measurement may be displayed in either metric units or English units.

**MEASUREMENT DATA STATISTICS
BY SURVEY**

DATA REQUESTED IN UNIT TYPE:

(A) METRIC UNITS

(B) ENGLISH UNITS

The active anthropometric surveys with measurement summary statistics are displayed. The user selects the survey from which the summary statistics are requested. Survey 1 is selected in the following example.

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│              MEASUREMENT DATA STATISTICS                    │
│                                                             │
│         SURVEY      SURVEY TITLE                            │
│                                                             │
│    (A)    1      AF FEMALE 1968 NONRATED                    │
│    (B)    6      AF FEMALE 1968 PILOT SUBSET                │
│    (C)    2      AF MALE PILOTS 1967                        │
│    (D)    3      AF MALE 1965 NONRATED                      │
│    (E)    8      AF MALE 1965 BLACK PILOT SUBSET            │
│    (F)    4      ARMY MALE 1966                             │
│    (G)    5      ARMY FEMALE 1977                           │
│    (H)    7      ARMY MALE 1977 SUBSET                      │
│    (I)    9      NAVY AVIATORS 1964                         │
│                                                             │
│                                                             │
│    (X)   RETURN TO PREVIOUS MENU                           │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

The measurement number, title or alternate name is entered on the next screen. If the measurement summary statistics option was requested, this screen would be followed by summary statistics and frequency data for the requested measurement.

If the percentile value query option was entered, the user will be prompted to input a measurement value for which a percentile is requested. An approximate percentile value for the measurement in the specified survey will be calculated. The input measurement value will be reported as out-of-range if not within range of the minimum and maximum measured values. In the example, the approximate percentile for a stature of 156.5 is requested in the 1968 AF Female nonrated survey.

MEASUREMENT DATA STATISTICS

STANDARD ABBREVIATIONS

BRTH - BREADTH		HT - HEIGHT	
CIRC - CIRCUMFERENCE		LTH - LENGTH	
DIAM - DIAMETER		SIT - SITTING	
DIST - DISTANCE		SKF - SKINFOLD	
EXT - EXTENSION		STD - STANDING	

MEASUREMENT TITLE OR NUMBER: STATURE

INPUT MEASUREMENT VALUE FOR PERCENTILE: 156.5

APPROXIMATE PERCENTILE: 19.5

Press <RETURN> to continue

If the measurement summary statistics option was selected, summary statistics for the requested measurement are displayed. Frequency data for each measurement are also available, and may be requested by entering a carriage return at the end of the summary statistics display. The frequency data will then be retrieved from the database and displayed. If an "S" is entered, frequency data will not be displayed.

MEASUREMENT SUMMARY STATISTICS

SURVEY NUMBER: 1 SURVEY NAME: AIR FORCE WOMEN 1968 NONRATED
METRIC NUMBER: 805 METRIC TITLE: STATURE

SAMPLE SIZE:	1905	MEAN:	162.10	STD DEV:	6.01
COEF. OF VARIATION:	3.70	SKEWNESS:	.16	KURTOSIS:	-.22
STD. ERROR OF MEAN:	.14	MINIMUM:	144.6	MAXIMUM:	183.0

| FIVE LOWEST: | 144.5 | 145.5 | 147.0 | 147.0 | 147.5 |
| FIVE HIGHEST: | 179.5 | 179.6 | 180.0 | 180.7 | 183.0 |

PERCENTILES:

1ST	2ND	3RD	5TH	10TH	25TH	50TH
149.5	150.5	151.3	152.4	154.3	157.8	162.0

75TH	90TH	95TH	97TH	98TH	99TH
166.2	169.9	172.1	173.6	174.7	176.5

PRESS <RETURN> FOR FREQ DATA, "S" TO STOP

FREQUENCY DATA

SURVEY NUMBER: 1   SURVEY NAME: AIR FORCE WOMEN 1968 NONRATED
METRIC NUMBER: 805   METRIC TITLE: STATURE
SAMPLE SIZE: 1905   MEAN: 162.10   STD DEV: 6.01

VALUE	CNT	PERCENTS CELL	CUM	VALUE	CNT	PERCENTS CELL	CUM
145.00	1	.1	.1	151.50	11	.6	3.5
145.50	1	.1	.1	152.00	18	.9	4.4
147.00	2	.1	.2	152.50	16	.8	5.2
147.50	2	.1	.3	153.00	22	1.2	6.4
148.00	4	.2	.5	153.50	20	1.0	7.5
148.50	1	.1	.6	154.00	25	1.3	8.8
149.00	5	.3	.8	154.50	25	1.3	10.1
149.50	7	.4	1.2	155.00	41	2.2	12.2
150.00	2	.1	1.3	155.50	44	2.3	14.5
150.50	11	.6	1.9	156.00	47	2.5	17.0
151.00	19	1.0	2.9	156.50	47	2.5	19.5

PRESS <RETURN> FOR FREQ DATA, "S" TO STOP

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MEASUREMENT STATISTICS ACROSS ALL SURVEYS

    Measurement statistics across multiple surveys may be viewed using this option. Selected univariate statistics will be displayed for a specified measurement across a maximum of 10 surveys.

    The active anthropometric surveys are displayed. The user selects from one to ten surveys to be compared. The surveys are selected using survey numbers separated by commas.

MEASUREMENT DATA STATISTICS
ACROSS SURVEYS

	SURVEY	SURVEY TITLE
(A)	1	AF FEMALE 1968 NONRATED
(B)	6	AF FEMALE 1968 PILOT SUBSET
(C)	2	AF MALE PILOTS 1967
(D)	3	AF MALE 1965 NONRATED
(E)	8	AF MALE 1965 BLACK PILOT SUBSET
(F)	4	ARMY MALE 1966
(G)	5	ARMY FEMALE 1977
(H)	7	ARMY MALE 1977 SUBSET
(I)	9	NAVY AVIATORS 1964

SELECT A MAXIMUM OF 10 SURVEYS (USE COMMAS AS SEPARATORS)
ENTER SURVEY NUMBERS: 1,2,3,9

Those users with level two access will be given the option to write the output to a data file. Summaries will be written to a file called MSTATS.LIS in the user's current directory. This file may be sent a designated printer on the FALCON VAX network.

Would you like the summaries written to a file? <Y/N>

The summary statistics for each measurement may be displayed in either metric units or English units.

**MEASUREMENT STATISTICS ACROSS SURVEYS
BY MEASUREMENT**

DATA REQUESTED IN UNIT TYPE:

(A) METRIC UNITS

(B) ENGLISH UNITS

The measurement number, title or alternate name requested is entered. The data base will be searched across those surveys requested. The message "Retrieving measurement data for selected surveys...Please wait" will be displayed on the screen. This screen will be followed by selected summary statistics across all surveys for the measurement requested.

MEASUREMENT DATA STATISTICS

STANDARD ABBREVIATIONS

BRTH	-	BREADTH	HT	- HEIGHT
CIRC	-	CIRCUMFERENCE	LTH	- LENGTH
DIAM	-	DIAMETER	SIT	- SITTING
DIST	-	DISTANCE	SKF	- SKINFOLD
EXT	-	EXTENSION	STD	- STANDING

MEASUREMENT TITLE OR NUMBER: STATURE

METRIC NUMBER: 805   METRIC TITLE: STATURE

NO.	SURVEY NAME	N	MEAN	STDDEV	MIN	MAX
1	AF FEMALE 1968 NONRATED	1905	162.10	6.01	144.60	183.00
2	AF MALE PILOTS 1967	2420	177.34	6.19	157.90	197.20
3	AF MALE 1965 NONRATED	3869	175.28	6.56	151.70	199.50
9	NAVY AVIATORS 1964	1529	177.64	5.92	161.30	195.90

PRESS <RETURN> TO CONTINUE

METRIC NUMBER: 805   METRIC TITLE: STATURE

SURVEY NAME	1ST	5TH	10TH	25TH	50TH
AF FEMALE 1968 NONRATED	149.50	152.40	154.30	157.80	162.00
AF MALE PILOTS 1967	163.30	167.30	169.40	173.10	177.20
AF MALE 1965 NONRATED	160.10	164.60	166.90	170.80	175.20
NAVY AVIATORS 1964	165.30	168.20	170.00	173.40	177.50

PRESS <RETURN> TO CONTINUE

```
METRIC NUMBER: 805        METRIC TITLE: STATURE

SURVEY NAME                     75TH    90TH    95TH    99TH

AF FEMALE 1968 NONRATED         166.20  169.90  172.10  176.50
AF MALE PILOTS 1967             181.50  185.40  187.70  191.90
AF MALE 1965 NONRATED           179.70  183.80  186.20  190.70
NAVY AVIATORS 1964              181.80  185.60  187.70  191.30




    PRESS <RETURN> TO CONTINUE
```

BUILD SAS DATA SET

This option allows authorized users to build SAS input command procedures to extract subject measurement data meeting certain criteria from a survey.

The active anthropometric surveys are displayed. The user selects the survey from which the SAS analysis is to be made.

```
ANALYZE DATA USING SAS

        SURVEY      SURVEY TITLE

    (A)    1     AF FEMALE 1968 NONRATED
    (B)    6     AF FEMALE 1968 PILOT SUBSET
    (C)    2     AF MALE PILOTS 1967
    (D)    3     AF MALE 1965 NONRATED
    (E)    8     AF MALE 1965 BLACK PILOT SUBSET
    (F)    4     ARMY MALE 1966
    (G)    5     ARMY FEMALE 1977
    (H)    7     ARMY MALE 1977 SUBSET
    (I)    9     NAVY AVIATORS 1964


    ACCESS DATA FOR WHICH SURVEY?

    ENTER SURVEY NUMBER:  1
```

Data may be processed in metric or English units. Units must remain consistent throughout the analysis. This is especially important when specifying data values for selection criteria input.

**MEASUREMENT DATA STATISTICS
BY SURVEY**

DATA REQUESTED IN UNIT TYPE:

(A) METRIC UNITS

(B) ENGLISH UNITS

(NOTE: CRITERIA INPUT MUST BE IN SAME UNITS CHOSEN)

New variables may be derived in the SAS job using existing measurement values. The user must be cautious about deriving new variables and should consult AL/CFHD on the validity of any derived variables. The default value is not to derive new variables.

ANALYZE DATA USING SAS

Would you like to derive new variables? (Y or N):

A maximum of five (5) new variables may be derived in a single SAS run. The maximum variable name length is eight (8), special characters such as dashes and dollar signs should be avoided in the variable name. Requested measurements and operators $(+, -, *, /, **)$ must be delimited with spaces to be processed correctly. Parentheses may be used for clarification.

In the example, a new variable, SHSD, is derived using existing measurement values. Measurements may be entered using the measurement number, title or alternate name.

ANALYZE DATA USING SAS
DERIVE NEW VARIABLES (MAX 5)
REQUESTED MEASUREMENTS AND OPERATORS MUST BE
DELIMITED WITH SPACES

NEW VARIABLE NAME TO CREATE (MAX 8 CHARS): SHSD
SHSD = 23 - (STATURE - 758)

This display screen supplies information on how to enter criteria input
for SAS. The subset of survey data to extract is determined by these criteria.

SAS DATA SELECTION CRITERIA INPUT

Define the subset of subjects you would like data extracted for.
A maximum of 30 criteria are allowed. A "+" continues criteria input
to the next line. A maximum of 9 input lines is allowed. Criteria must
be entered in the units (metric or English) previously selected
Comparison operators include:

    $<$ or LT (less than) $<=$ or LE (less than or equal to)
    $>$ or GT (greater than) $>=$ or GE (greater than or equal to)
    $=$ or EQ (equal to)   NE (not equal to)

Logical operators include:
  & or AND (Logical AND) | or OR (logical OR) NOT (Logical NOT)

Parentheses may be used to clarify SAS input criteria.
For example, to select subject data where age is over 21 and up to and
including 25.5 with stature less that 170.0, your criteria input is:

CRITERIA: (AGE $>$ 21 AND AGE $<=$ 25.5) AND STATURE LT 170.0

    Press <RETURN> to continue

Criteria are entered from this screen. Valid comparison and logical operators are displayed. Criteria measurement variables may be entered by measurement name, title, or alternate name. Criteria are checked for a valid sequence of input by the program but the logic of the command cannot be checked. This can result in the SAS procedure not finding any data which meet the criteria specified. Data values specified in criteria selection must be entered in units selected. Criteria may be entered across lines if a '+' is entered on the preceding line.

In the sample display, data are requested for those subjects with ages greater than or equal to 17.5 years and less than or equal to 25 years whose stature is greater than 170.0 cm and less than or equal to 180.0 cm.

ANALYZE DATA USING SAS

COMPARISON OPERATORS:

<	or LT	(less than)	<=	or LE	(less than or equal to)
>	or GT	(greater than)	>=	or GE	(greater than or equal to)
=	or EQ	(equal to)		NE	(not equal to)

LOGICAL OPERATORS:
& or AND (Logical AND) | or OR (logical OR) NOT (Logical NOT)

PARENTHESES ( ) TO CLARIFY CRITERIA,   "+" TO CONTINUE A LINE

CRITERIA: (AGE GE 17.5 AND AGE LE 25) AND +
CRITERIA: (STATURE > 170.0 AND STATURE <= 180.0)

A procedure file will be created with SAS commands to run the UNI-VARIATE procedure for the data requested. Measurement data for selection criteria variables are automatically analyzed by SAS and the option to analyze up to 10 additional measurement variables is available. These are entered by measurement number, title, or alternate name. In the sample display, the measurements SITTING-HT and measurement number 957 will be analyzed in SAS along with AGE and STATURE as specified in the criteria input.

ANALYZE DATA USING SAS

REQUESTING DATA FOR WHICH MEASUREMENTS? (MAX 10)

MEASUREMENT NUMBER OR TITLE: STATURE
MEASUREMENT NUMBER OR TITLE: SITTING-HT
MEASUREMENT NUMBER OR TITLE: 957
MEASUREMENT NUMBER OR TITLE: <RETURN>

The SAS job has now been built and will be submitted to the VAX to execute. A message will be displayed while it is executing. This may take a few minutes depending on the size of the data set being built.

The SAS log file will be displayed to
allow you to review the run. You will
be in the VAX EDT editor. You must enter
<cntrl-Z> and QUIT to continue.

When the SAS job is complete, the VAX editor EDIT will be invoked and will display the SAS log file as shown in Figure 1. This file should be examined to make sure the run executed successfully and contained the expected results. Always check the number of observations placed in the SAS data set to verify your expectations of the number of people in the sample.

After you have checked out the log file, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'QUIT' to exit the editor.

The next screen will ask the user if the SAS run was correct, a Y (yes) or a N (no) is entered. When a No is entered, the user will be asked if the SAS procedure is to be edited. If this is desired, the software will call the VAX editor and allow the user to edit the SAS job file. After the changes are made to the job file, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'EXIT' to exit the editor. This will save the changes made to the job file. The software will resubmit the new SAS job and proceed as before in verifying the results.

Did this SAS job run okay? <Y/N/CR=N>?

Answer <Y>es to see the results from the SAS job.
<N>o to have the option to modify and resubmit the SAS job.

Copyright(c)1984,1986,1987,1988 SAS Institute Inc., Cary,N.C. 27512,U.S.A.
NOTE:VMS SAS Production Release 6.18 WRIGHT-PATTERSON AIR FORCE BASE/AFAMRL
NOTE: LICENSED CPUID MODEL = VAX 8650, SERIAL = 0483C7C9.

```
     1  LIBNAME APDATA ''ANTHRO$DISK:[APDATA]'';
     2  DATA QUERYSET;
     3  LABEL M23=''ACROMION-HT'';
     4  LABEL M48=''AGE'';
     5  LABEL M758=''SITTING-HT'';
     6  LABEL M805=''STATURE'';
     7  LABEL M957=''WEIGHT'';
     8  OPTIONS LINESIZE=75;
     9  SET APDATA.AFW68
    10  (KEEP=M23 M48 M758 M805 M957 );
    11  SHSD    = M23 - ( M805 -   M758);
    12  IF( (M48 GE   17.5 AND
    13  M48 LE   25) AND
    14  (M805 >   170.0 AND
    15  M805 <=   180.0) );
    16  RUN;
```
NOTE: THE DATA SET WORK.QUERYSET HAS 126 OBSERVATIONS AND 6 VARIABLES.
NOTE: THE DATA STEP USED 00:00:02.17 CPU SECONDS, 186 PAGEFAULTS.
```
    17  PROC UNIVARIATE FREQ DATA=QUERYSET;
    18  RUN;
```
NOTE: THE PROCEDURE UNIVARIATE USED 00:00:01.27 CPU SECONDS, 198
      PAGEFAULTS.
NOTE: THE PROCEDURE PRINTED PAGES 1 THROUGH 11.
NOTE: SAS INSTITUTE INC., SAS CIRCLE, BOX 8000, CARY, N. C., 27512-8000.

Figure 1. SAS Log File

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If a Yes was entered and the SAS run appeared to be correct, the results from the SAS analysis job will be displayed on the screen as shown in Figure 2. The software will call the VAX editor and allow the user to view the SAS results file. When the file has been reviewed, enter a <cntrl-Z> which brings you to the '*' prompt and enter 'QUIT' to exit the editor.

Would you like to PRINT results from this SAS job? <Y/N>?

Would you like to EDIT and RESUBMIT this SAS job? <Y/N>?

If logged into a regular VAX account (not ANTHRO), the user will be asked if a hard copy of the SAS output is requested. A hard copy will be sent to the user's default printer.

When reviewing the SAS analysis results, if a correction needs to be made or the original run modified, the option is given to edit and resubmit the SAS job using the procedures discussed previously.

UNIVARIATE

VARIABLE=M23   ACROMION-HT

MOMENTS

N	126	SUM WGTS	126
MEAN	141.142	SUM	17783.9
STD DEV	2.54626	VARIANCE	6.48342
SKEWNESS	0.580493	KURTOSIS	0.250029
USS	2510867	CSS	810.427
CV	1.80404	STD MEAN	0.226838
T:MEAN=0	622.214	PROB>|T|	0.0001
SGN RANK	4000.5	PROB>|S|	0.0001
NUM ^= 0	126		

QUANTILES(DEF=4)   EXTREMES

100% MAX	148.4	99%	148.238			
75% Q3	142.5	95%	146.695		LOWEST	HIGHEST
50% MED	141	90%	144.66		135.8	146.9
25% Q1	139.4	10%	138.17		136.4	147
0% MIN	135.8	5%	137.5		136.6	147.2
		1%	135.962		136.7	147.8
RANGE	12.6				136.7	148.4
Q3-Q1	3.10001					
MODE	139					

Figure 2. SAS Results File

UNIVARIATE

VARIABLE=M23   ACROMION-HT

FREQUENCY TABLE

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
135.8	1	0.8	0.8	141.6	3	2.4	60.3
136.4	1	0.8	1.6	141.7	3	2.4	62.7
136.6	1	0.8	2.4	141.8	1	0.8	63.5
136.7	2	1.6	4.0	142	2	1.6	65.1
137.5	2	1.6	5.6	142.1	1	0.8	65.9
137.7	1	0.8	6.3	142.2	6	4.8	70.6
137.8	1	0.8	7.1	142.3	3	2.4	73.0
138	2	1.6	8.7	142.4	1	0.8	73.8
138.1	1	0.8	9.5	142.5	5	4.0	77.8
138.2	2	1.6	11.1	142.7	1	0.8	78.6
138.5	2	1.6	12.7	142.9	1	0.8	79.4
138.6	1	0.8	13.5	143	2	1.6	81.0
138.7	1	0.8	14.3	143.1	2	1.6	82.5
138.9	1	0.8	15.1	143.2	1	0.8	83.3
139	8	6.3	21.4	143.5	1	0.8	84.1
139.2	3	2.4	23.8	143.6	1	0.8	84.9
139.4	4	3.2	27.0	143.7	2	1.6	86.5
139.5	3	2.4	29.4	144	2	1.6	88.1
139.6	5	4.0	33.3	144.1	1	0.8	88.9
139.7	3	2.4	35.7	144.5	1	0.8	89.7
139.8	1	0.8	36.5	144.6	1	0.8	90.5
139.9	3	2.4	38.9	144.8	1	0.8	91.3
140	3	2.4	41.3	145	2	1.6	92.9
140.1	1	0.8	42.1	145.3	1	0.8	93.7
140.2	2	1.6	43.7	146.2	1	0.8	94.4
140.6	2	1.6	45.2	146.5	1	0.8	95.2
140.8	3	2.4	47.6	146.8	1	0.8	96.0
140.9	1	0.8	48.4	146.9	1	0.8	96.8
141	5	4.0	52.4	147	1	0.8	97.6
141.1	2	1.6	54.0	147.2	1	0.8	98.4
141.2	1	0.8	54.8	147.8	1	0.8	99.2
141.3	2	1.6	56.3	148.4	1	0.8	100.0
141.4	2	1.6	57.9				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M48   AGE

MOMENTS

N	126	SUM WGTS	126
MEAN	20.8016	SUM	2621
STD DEV	1.83421	VARIANCE	3.36432
SKEWNESS	0.40581	KURTOSIS	-0.948193
USS	54941.5	CSS	420.54
CV	8.81763	STD MEAN	0.163404
T:MEAN=0	127.301	PROB>|T|	0.0001
SGN RANK	4000.5	PROB>|S|	0.0001
NUM ^= 0	126		

QUANTILES(DEF=4)				EXTREMES	
				LOWEST	HIGHEST
100% MAX	24.5	99%	24.5		
75% Q3	22.5	95%	24.5	18.5	24.5
50% MED	20.5	90%	23.5	18 5	24.5
25% Q1	19.5	10%	18.5	18.5	24.5
0% MIN	18.5	5%	18.5	18.5	24.5
		1%	18.5	18.5	24.5
RANGE	6				
Q3-Q1	3				
MODE	19.5				

FREQUENCY TABLE

		PERCENTS				PERCENTS	
VALUE	COUNT	CELL	CUM	VALUE	COUNT	CELL	CUM
18.5	25	19.8	19.8	22.5	16	12.7	84.9
19.5	28	22.2	42.1	23.5	12	9.5	94.4
20.5	18	14.3	56.3	24.5	7	5.6	100.0
21.5	20	15.9	72.2				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M758   SITTING-HT

MOMENTS

N	126	SUM WGTS	126
MEAN	89.7984	SUM	11314.6
STD DEV	2.24332	VARIANCE	5.03248
SKEWNESS	-0.101585	KURTOSIS	0.154019
USS	1016662	CSS	629.06
CV	2.49817	STD MEAN	0.199851
T:MEAN=0	449.328	PROB>|T|	0.0001
SGN RANK	4000.5	PROB>|S|	0.0001
NUM ^= 0	126		

QUANTILES(DEF=4)				EXTREMES	
100% MAX	95	99%	94.946	LOWEST	HIGHEST
75% Q3	91.425	95%	93.9	82.6	94
50% MED	89.7	90%	92.6	85	94.1
25% Q1	88.4	10%	86.9	85.2	94.2
0% MIN	82.6	5%	85.94	85.6	94.8
		1%	83.248	85.7	95
RANGE	12.4				
Q3-Q1	3.025				
MODE	88.7				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M758   SITTING-HT

FREQUENCY TABLE

VALUE	COUNT	PERCENTS		VALUE	COUNT	PERCENTS	
		CELL	CUM			CELL	CUM
82.6	1	0.8	0.8	89.7	3	2.4	51.6
85	1	0.8	1.6	89.9	3	2.4	54.0
85.2	1	0.8	2.4	90	4	3.2	57.1
85.6	1	0.8	3.2	90.1	1	0.8	57.9
85.7	1	0.8	4.0	90.2	3	2.4	60.3
85.8	1	0.8	4.8	90.5	3	2.4	62.7
86.2	1	0.8	5.6	90.6	3	2.4	65.1
86.4	1	0.8	6.3	90.7	1	0.8	65.9
86.6	2	1.6	7.9	90.9	2	1.6	67.5
86.8	1	0.8	8.7	91	3	2.4	69.8
86.9	2	1.6	10.3	91.1	1	0.8	70.6
87.1	2	1.6	11.9	91.2	2	1.6	72.2
87.4	2	1.6	13.5	91.3	3	2.4	74.6
87.5	3	2.4	15.9	91.4	1	0.8	75.4
87.7	1	0.8	16.7	91.5	4	3.2	78.6
87.8	1	0.8	17.5	91.6	2	1.6	80.2
87.9	2	1.6	19.0	91.7	2	1.6	81.7
88	2	1.6	20.6	91.8	1	0.8	82.5
88.1	1	0.8	21.4	92	4	3.2	85.7
88.2	2	1.6	23.0	92.1	1	0.8	86.5
88.3	1	0.8	23.8	92.3	2	1.6	88.1
88.4	2	1.6	25.4	92.5	2	1.6	89.7
88.5	3	2.4	27.8	92.6	2	1.6	91.3
88.6	1	0.8	28.6	92.8	1	0.8	92.1
88.7	5	4.0	32.5	93.2	1	0.8	92.9
88.8	2	1.6	34.1	93.3	1	0.8	93.7
88.9	4	3.2	37.3	93.6	1	0.8	94.4
89	2	1.6	38.9	93.9	2	1.6	96.0
89.1	2	1.6	40.5	94	1	0.8	96.8
89.2	1	0.8	41.3	94.1	1	0.8	97.6
89.3	3	2.4	43.7	94.2	1	0.8	98.4
89.4	1	0.8	44.4	94.8	1	0.8	99.2
89.5	4	3.2	47.6	95	1	0.8	100.0
89.6	2	1.6	49.2				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M805   STATURE

MOMENTS

N	126	SUM WGTS	126
MEAN	172.746	SUM	21766
STD DEV	2.24836	VARIANCE	5.05514
SKEWNESS	1.21956	KURTOSIS	1.03412
USS	3760622	CSS	631.893
CV	1.30154	STD MEAN	0.2003
T:MEAN=0	862.435	PROB>|T|	0.0001
SGN RANK	4000.5	PROB>|S|	0.0001
NUM ^= 0	126		

QUANTILES(DEF=4)				EXTREMES	
100% MAX	179.6	99%	179.573		
75% Q3	173.6	95%	177.52	LOWEST	HIGHEST
50% MED	172.15	90%	176.52	170.1	178.4
25% Q1	171	10%	170.5	170.1	178.9
0% MIN	170.1	5%	170.235	170.1	179
		1%	170.1	170.1	179.5
RANGE	9.5			170.2	179.6
Q3-Q1	2.60001				
MODE	170.5				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M805   STATURE

FREQUENCY TABLE

VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM
170.1	4	3.2	3.2	173.3	5	4.0	69.8
170.2	2	1.6	4.8	173.4	1	0.8	70.6
170.3	2	1.6	6.3	173.5	5	4.0	74.6
170.4	2	1.6	7.9	173.6	3	2.4	77.0
170.5	12	9.5	17.5	173.7	1	0.8	77.8
170.7	2	1.6	19.0	173.8	3	2.4	80.2
170.8	2	1.6	20.6	174	2	1.6	81.7
170.9	1	0.8	21.4	174.2	1	0.8	82.5
171	8	6.3	27.8	174.4	1	0.8	83.3
171.1	1	0.8	28.6	174.5	1	0.8	84.1
171.3	2	1.6	30.2	175	2	1.6	85.7
171.4	2	1.6	31.7	175.4	1	0.8	86.5
171.5	6	4.8	36.5	175.6	1	0.8	87.3
171.6	4	3.2	39.7	176	1	0.8	88.1
171.8	1	0.8	40.5	176.2	1	0.8	88.9
171.9	1	0.8	41.3	176.4	2	1.6	90.5
172	10	7.9	49.2	176.8	2	1.6	92.1
172.1	1	0.8	50.0	177	4	3.2	95.2
172.2	2	1.6	51.6	177.8	1	0.8	96.0
172.4	1	0.8	52.4	178.4	1	0.8	96.8
172.5	8	6.3	58.7	178.9	1	0.8	97.6
172.6	2	1.6	60.3	179	1	0.8	98.4
172.8	1	0.8	61.1	179.5	1	0.8	99.2
173	5	4.0	65.1	179.6	1	0.8	100.0
173.2	1	0.8	65.9				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M957   WEIGHT

MOMENTS

N	126	SUM WGTS	126
MEAN	63.434	SUM	7992.68
STD DEV	6.70441	VARIANCE	44.9491
SKEWNESS	0.601592	KURTOSIS	1.31992
USS	512626	CSS	5618.64
CV	10.5691	STD MEAN	0.597276
T:MEAN=0	106.205	PROB>|T|	0.0001
SGN RANK	4000.5	PROB>|S|	0.0001
NUM ^= 0	126		

QUANTILES(DEF=4)   EXTREMES

100% MAX	88.9	99%	87.4312		
75% Q3	68.04	95%	74.5055	LOWEST	HIGHEST
50% MED	63.05	90%	71.21	49.9	76.66
25% Q1	58.855	10%	55.34	49.9	77.11
0% MIN	49.9	5%	52.62	50.35	80.74
		1%	49.9	50.8	83.46
RANGE	39			51.71	88.9
Q3-Q1	9.185				
MODE	61.23				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=M957   WEIGHT

FREQUENCY TABLE

		PERCENTS				PERCENTS	
VALUE	COUNT	CELL	CUM	VALUE	COUNT	CELL	CUM
49.9	2	1.6	1.6	63.96	2	1.6	55.6
50.35	1	0.8	2.4	64.41	1	0.8	56.3
50.8	1	0.8	3.2	64.86	4	3.2	59.5
51.71	1	0.8	4.0	65.32	4	3.2	62.7
52.62	2	1.6	5.6	65.77	3	2.4	65.1
53.07	1	0.8	6.3	66.22	6	4.8	69.8
54.88	3	2.4	8.7	66.68	4	3.2	73.0
55.34	2	1.6	10.3	67.59	2	1.6	74.6
55.79	2	1.6	11.9	68.04	5	4.0	78.6
56.25	2	1.6	13.5	68.49	3	2.4	81.0
56.7	2	1.6	15.1	68.95	2	1.6	82.5
57.15	5	4.0	19.0	69.4	3	2.4	84.9
57.61	1	0.8	19.8	69.85	5	4.0	88.9
58.06	3	2.4	22.2	70.76	1	0.8	89.7
58.51	3	2.4	24.6	71.21	2	1.6	91.3
58.97	4	3.2	27.8	71.67	1	0.8	92.1
59.42	1	0.8	28.6	72.12	1	0.8	92.9
59.87	3	2.4	31.0	72.57	1	0.8	93.7
60.33	2	1.6	32.5	73.03	2	1.6	95.2
60.78	4	3.2	35.7	75.3	1	0.8	96.0
61.23	7	5.6	41.3	76.66	1	0.8	96.8
61.69	2	1.6	42.9	77.11	1	0.8	97.6
62.14	6	4.8	47.6	80.74	1	0.8	98.4
62.6	2	1.6	49.2	83.46	1	0.8	99.2
63.05	5	4.0	53.2	88.9	1	0.8	100.0
63.5	1	0.8	54.0				

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=SHSD

MOMENTS

N	126	SUM WGTS	126
MEAN	58.1944	SUM	7332.5
STD DEV	2.39911	VARIANCE	5.75573
SKEWNESS	0.00411599	KURTOSIS	-0.292252
USS	427430	CSS	719.466
CV	4.12258	STD MEAN	0.21373
T:MEAN=0	272.281	PROB>|T|	0.0001
SGN RANK	4000.5	PROB>|S|	0.0001
NUM ^= 0	126		

QUANTILES(DEF=4)

					EXTREMES	
100% MAX	63.8	99%	63.773		LOWEST	HIGHEST
75% Q3	59.825	95%	62.3		52.8	62.7
50% MED	58.2	90%	61.23		53.5	63
25% Q1	56.8	10%	54.4		53.6	63.1
0% MIN	52.8	5%	54		53.9	63.7
		1%	52.989		54	63.8
RANGE	11					
Q3-Q1	3.025					
MODE	56.8					

Figure 2. SAS Results File (cont.)

UNIVARIATE

VARIABLE=SHSD

FREQUENCY TABLE

VALUE	COUNT	PERCENTS CELL	CUM		VALUE	COUNT	PERCENTS CELL	CUM
52.8	1	0.8	0.8		58.4	4	3.2	56.3
53.5	1	0.8	1.6		58.6	3	2.4	58.7
53.6	1	0.8	2.4		58.7	6	4.8	63.5
53.9	1	0.8	3.2		58.8	2	1.6	65.1
54	4	3.2	6.3		59	1	0.8	65.9
54.1	2	1.6	7.9		59.2	3	2.4	68.3
54.3	1	0.8	8.7		59.3	1	0.8	69.0
54.4	2	1.6	10.3		59.5	3	2.4	71.4
54.8	1	0.8	11.1		59.7	3	2.4	73.8
54.9	3	2.4	13.5		59.8	2	1.6	75.4
55.4	1	0.8	14.3		59.9	2	1.6	77.0
55.6	1	0.8	15.1		60	4	3.2	80.2
55.7	1	0.8	15.9		60.1	1	0.8	81.0
56.1	3	2.4	18.3		60.2	1	0.8	81.7
56.2	2	1.6	19.8		60.3	1	0.8	82.5
56.3	2	1.6	21.4		60.6	3	2.4	84.9
56.6	2	1.6	23.0		60.7	1	0.8	85.7
56.8	6	4.8	27.8		60.9	2	1.6	87.3
56.9	1	0.8	28.6		61	2	1.6	88.9
57.1	2	1.6	30.2		61.2	2	1.6	90.5
57.3	3	2.4	32.5		61.3	1	0.8	91.3
57.4	4	3.2	35.7		61.8	1	0.8	92.1
57.5	3	2.4	38.1		62	1	0.8	92.9
57.6	2	1.6	39.7		62.1	2	1.6	94.4
57.7	3	2.4	42.1		62.3	2	1.6	96.0
57.8	2	1.6	43.7		62.7	1	0.8	96.8
57.9	2	1.6	45.2		63	1	0.8	97.6
58	4	3.2	48.4		63.1	1	0.8	98.4
58.2	3	2.4	50.8		63.7	1	0.8	99.2
58.3	3	2.4	53.2		63.8	1	0.8	100.0

Figure 2. SAS Results File (cont.)

7.1.6 MULTIVARIATE COCKPIT ACCOMMODATION MODELS

This option gives the user access to multivariate data models for cockpit accommodation. These models have been derived by AL/CFHD and include maximum and minimum cockpit clearance values and body-size models with various combinations of torso and limb lengths.

MULTIVARIATE COCKPIT ACCOMMODATION MODELS

This menu option is provided to assist crewstation designers by providing a series of test case individuals (models). These individuals have a variety of combinations of torso and limb lengths. The mythical 95th percentile aviator (or 5th percentile female, etc.) does not exist because percentiles are only relevant for one dimension at a time (univariate).

MIL-STD 1472 requires that "Where two or more dimensions are used simultaneously as design parameters, appropriate multivariate data and techniques should be utilized." MIL-STD 1800 states "univariate accommodation shall not be sufficient unless multivariate accommodation (of some specified level) is also accomplished." (Pages 129-133 in MIL-STD 1800 discuss univariate vs. multivariate accommodation.)

These models represent a multivariate approach to body size accommodation. When each of them is capable of reaching and clearing relevant structures in the cockpit the listed percentage of the USAF population can be assumed to be accommodated as well.

The multivariate cockpit accommodation models menu presents options for data available on the multivariate body-size models. The sample statistics option contains the multivariate models for various sample populations. These populations are described in the combined sample descriptions option. Measurement descriptions may also be accessed from this menu.

MULTIVARIATE COCKPIT ACCOMMODATION MODELS

(A) SAMPLE STATISTICS

(B) COMBINED SAMPLE DESCRIPTIONS

(C) MEASUREMENT DESCRIPTIONS

(X) RETURN TO MAIN MENU

SELECT OPTION BY LETTER OR ARROWS AND PRESS RETURN

Multivariate accommodation body-size model measurements may be displayed in either metric or English units.

```
┌─────────────────────────────────────────────────────────┐
│                                                         │
│         MULTIVARIATE ACCOMMODATION MODELS               │
│                                                         │
│                                                         │
│                                                         │
│         DATA REQUESTED IN UNIT TYPE:                    │
│                                                         │
│         (A) METRIC UNITS                                │
│                                                         │
│         (B) ENGLISH UNITS                               │
│                                                         │
│                                                         │
│                                                         │
│                                                         │
└─────────────────────────────────────────────────────────┘
```

SAMPLE STATISTICS

The Sample Statistics menu lists the sample populations for which multivariate body-size models for cockpit accommodation were derived. Option is selected by sample population mix and percent of accommodation desired.

```
+--------------------------------------------------------------+
|                                                              |
|           SELECT THE PERCENTAGE AND THE SAMPLE               |
|              TO BE INCLUDED IN THE DESIGN:                   |
|                                                              |
|                                                              |
|    (A)    90% of USAF Pilots (Male and Female)               |
|    (B)    95% of USAF Pilots (Male and Female)               |
|    (C)    98% of USAF Pilots (Male and Female)               |
|    (D)    99% of USAF Pilots (Male and Female)               |
|                                                              |
|    (E)    All USAF Personnel (Male and Female) between the 5th|
|           and 99th Percentiles for Stature (based on civilian data)|
|           This represents a range of 60 to 76 inches.        |
|                                                              |
|    (X)    RETURN TO PREVIOUS MENU                            |
|                                                              |
+--------------------------------------------------------------+
```

Minimum and maximum clearance values for selected measurements to be considered in a cockpit design will be displayed. Values will be in the units previously selected.

COCKPIT ACCOMMODATION CLEARANCE VALUES

Minimum and maximum clearance values for the following dimensions should be considered in a cockpit design. 99% of male USAF pilots are within these limits (multivariately). These values do not represent a small and a large individual. Therefore other dimensions should not be derived by adding or subtracting them. Values are in centimeters and kilograms.

	min	max		min	max
Sitting Ht	86.4	98.8	Chest Circ	75.2	121.9
Eye Ht Sitting	73.4	87.4	Chest Depth	16.8	31.0
Mid-Shoulder Ht Sit	56.9	71.1	Hip Breadth Sit	29.7	45.7
Shoulder Ht Sitting	50.8	68.1	Thigh Clearance	11.4	20.3
Shoulder Breadth	38.6	55.1	Buttock-Knee Lth	52.6	70.6
Shoulder-Elbow Length	31.8	42.2	Buttock-Popliteal Lth	42.2	58.9
Forearm-Forearm Brth	36.8	64.8	Knee Height Sit	47.5	64.3
Elbow Rest Ht	15.5	32.3	Popliteal Ht Sit	38.9	53.8
Elbow-Wrist Length	24.9	35.1	Foot Length	23.4	31.5
Hand Length	17.0	23.6	Head Length	17.3	21.8
Thumb Tip Reach	67.1	93.0	Weight (kgs)	46.3	111.1

Press <RETURN> to continue

The following screens display the body size models developed using multivariate methods. The models are represented using combinations of limb and torso lengths. The technique used to calculate these models is discussed in the Multivariate Analysis package description beginning in section 8.

MULTIVARIATE COCKPIT ACCOMMODATION MODELS

90% OF MALE USAF PILOTS

MODELS

MEASUREMENTS (cm)	1 SHORT ON EVERYTHING	2 SHORTEST TORSO	3 SHORTEST LIMBS	4 SHORT LIMBS LONG TORSO
Thumb Tip Reach	74.1	79.5	71.4	73.1
Buttock Knee Length	57.0	60.8	55.1	56.2
Popliteal Ht Sitting	42.1	45.2	40.6	41.4
Sitting Height	86.5	86.4	89.9	94.2
Eye Height Sitting	75.2	75.1	78.4	82.5
Shoulder Height Sit	55.4	54.9	58.7	62.5

Press <RETURN> to continue

MULTIVARIATE COCKPIT ACCOMMODATION MODELS

90% OF MALE USAF PILOTS

MODELS

MEASUREMENTS (cm)	5 LONG ON EVERYTHING	6 LONGEST TORSO	7 LONGEST LIMBS	8 SHORT TORSO LONG LIMBS
Thumb Tip Reach	83.4	78.0	86.1	84.5
Buttock Knee Length	63.5	59.7	65.4	64.3
Popliteal Ht Sitting	47.4	44.3	49.0	48.1
Sitting Height	96.3	96.8	92.9	88.6
Eye Height Sitting	84.7	85.1	81.5	77.4
Shoulder Height Sit	63.8	64.6	60.5	56.6

Press <RETURN> to continue

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COMBINED SAMPLE DESCRIPTIONS

The Combined Sample Descriptions option furnishes explanations on how sample populations were derived for the cockpit accommodation mul-tivariate models.

COMBINED SAMPLE DESCRIPTIONS

There has not been an anthropometric survey of the USAF population since the 1960's. In order to establish a data set representative of USAF personnel some restructuring of data was necessary. The 1967 USAF flyers survey consisted of essentially a totally white male population and at that time there was no sitting height restriction for entry into flight school. In order to include females and blacks in this data, samples were derived from the 1965 non-rated and 1968 female USAF anthropometric surveys. These samples were truncated to match current USAF anthropometric restrictions for flyers. That is - 64 to 76 inches in stature and 34 to 39 inches in sitting height. All individuals are within the weight restriction for USAF service. Each of these data sets were checked and compared to the 1967 USAF flyers survey and the results are quite similar.

    (A) USAF PILOTS - MALE AND FEMALE

    (B) USAF PERSONNEL - MALE AND FEMALE

    (X) RETURN TO PREVIOUS MENU

USAF PERSONNEL - MALE AND FEMALE

The USAF personnel population (Male and Female) consists
of 3 groups representing white males, black males and females. All
male selections are derived from the 1965 anthropometric survey of
USAF personnel. The female data comes from the 1968
survey of USAF female personnel. Here the restrictions for
flyers based upon stature and sitting height were not applied.
Only individuals between 60 and 76 inches who also meet weight
restrictions are considered.

Press <RETURN> to continue

MEASUREMENT DESCRIPTIONS

This option allows the user to access descriptions of measurements. Section 7.1.4 describes this option in detail.

7.1.7 ATF MAINTAINER CLEARANCE VALUES

This option displays extreme size ranges for ATF maintenance personnel. Data may be requested in either metric or English units.

ATF MAINTAINERS CLEARANCE VALUES
BY SURVEY

DATA REQUESTED IN UNIT TYPE:

(A) METRIC UNITS

(B) ENGLISH UNITS

The following two screens display maximum and minimum values for selected body measurements for ATF maintenance personnel.

ATF MAINTAINERS CLEARANCE VALUES

The following list of measurements gives minimum and maximum values for a number of body dimensions which describe the extreme size range for maintainers. 99% of USAF personnel between the 5th and 95th percentiles in stature fall within these limits. These values do not represent a small and large individual, they are not additive, other dimensions should not be derived by adding or subtracting them.

The following ten measurements are considered critical and are required for ATF design.

	min	max		min	max
Stature	152.4	188.0	Forearm Circ Extended	20.1	33.0
Shoulder Height	120.7	157.2	Hand Circ w/Thumb	21.4	29.2
Sitting Height	77.5	101.6	Shoulder Breadth	31.0	45.2
Thumb-Tip Reach	63.2	93.0	Chest Depth	16.5	31.0
Thumb-Tip Reach Extended	71.9	104.4	Hip Breadth	28.4	42.7

(Values are in centimeters)

Press <RETURN> to continue

ATF MAINTAINERS CLEARANCE VALUES

The following table gives minimum and maximum values for additional measurements which may be considered for ATF design

	min	max		min	max
Trochanterion Height	72.6	109.0	Hand Length	16.0	22.9
Tibiale Height	36.1	57.1	Hand Thickness	2.1	3.8
Buttock Knee Length	50.3	70.1	Hand Circ Metacarple	15.2	25.4
Popliteal Ht Sitting	35.6	51.6	Head Length	16.5	21.8
Acromion-Radiale Length	26.7	36.3	Head Breadth	13.0	17.3
Radiale-Stylion Lth	19.8	31.0	Chest Breadth	22.9	40.6
Shoulder-Elbow Length	28.7	41.9	Waist Breadth	19.6	39.4
Elbow-Wrist Length	22.1	33.3	Waist Depth	13.2	32.8
Wrist Breadth	4.6	6.9	Weight (kgs)	42.6	110.7
Wrist Circumference	13.0	20.3			

(Values are in centimeters except for weight which is in kilograms)

Press <RETURN> to continue

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7.1.8 <u>EXIT GENERAL ANALYSIS</u>

<u>REGULAR VAX ACCOUNT</u>

For users running from a regular VAX account (not ANTHRO), if a SAS procedure was executed, file information for the SAS job will be displayed. Included are instructions on how to review and print the SAS files. The option to rename the SAS procedure and output files for further review or use in subsequent analysis is given. A new file name without file extension is entered and the SAS files are renamed. The following script will be displayed:

```
To look at your SAS run LOG file and/or output file LIS,
use the commands:

    TYPE SASPROC.LOG
    TYPE SASPROC.LIS

To print your results, use the command:

    PRINT SASPROC.LOG
    PRINT SASPROC.LIS

FILES:

    SASPROC.SAS - SAS commands
    SASPROC.LOG - execution information for SAS job
    SASPROC.LIS - SAS results

Would you like to RENAME and save this SASPROC?: y

The new files will retain the current file extensions of .SAS,
.LOG, and .LIS. These files will not be deleted at the execution
of QUERY.

Enter new file name (DO NOT include the file extension): NE SAS

Files have been renamed and reside in your directory:

Directory [xxx]
    NEWSAS.LIS;1      NEWSAS.LOG;1      NEWSAS.SAS;1
Total of 3 Files.
```

The SAS files generated include SASPROC.SAS which contains the SAS commands and is the file submitted to the system to run the SAS job. The SAS log file SASPROC.LOG generated gives information on how many observations (subjects) met the specified criteria and the number of measurement variables which were analyzed. The log file will also inform you if a measurement was not available in a survey. In the case where the selection criteria were not logical or where there were no subjects who met the specified criteria, the log file will report that zero observations were made. SASPROC.LIS contains the SAS UNIVARIATE procedure output file. This file will not exist if zero observations were made in the SAS job.

Each time a SAS authorized user runs the QUERY database program, any existing SASPROC.SAS, SASPROC.LOG, and SASPROC.LIS files are deleted. In the case where the user would like to save these files, before QUERY is executed again, the RENAME option may be used to rename these files so they will not be deleted.

ANTHRO ACCOUNT USERS

Users running from the account ANTHRO will see the message:

Cleaning up file space ... Please wait.

Temporary file space on the FALCON is being reclaimed at the time. When the message:

"ANTHRO System finished. Exiting system . ."

DSS:DISCONNECTED

is displayed, the FALCON VAX has been disconnected from the data switch and the connection may be terminated.

8. MULTIVARIATE ANALYSIS PACKAGE

The Multivariate Analysis Package provides a menu-driven software interface between the SAS statistical package and the model point program developed by Dr Richard Meindl, Kent State University. The multivariate techniques used are discussed in the June 1989 report "Multivariate Accommodation Models Based upon Anthropometric Data on Flying Personnel," authors Richard S. Meindl, Gregory F. Zehner, and Jeffrey A. Hudson.

This option furnishes input data to the model point program including building and executing SAS procedures using data specified by the user, reformatting the data as required, and calculating accommodation circle radius values needed for analysis.

8.1 ANALYSIS INFORMATION SCREEN

The first screen requests an analysis name and directory specification from the user. The name of the analysis, 8 characters maximum, is the name which specifies file names to be used during the analysis. SAS job file names and analysis output file names are determined from this name. For example, if you input FLYERS67 as the name of the analysis, the SAS job will be FLYERS67.SAS, the analysis output name will be FLYERS67.OUT, etc.

If logged into a regular VAX account (not ANTHRO), the user will be prompted to specify a VAX directory name. The VAX username is entered to direct SAS jobs to a directory where input and output files will be stored for access. This is usually your user directory or a subdirectory. By keeping track of the analysis name, these users can use the same derived population for a variety of analyses. In this case, you must make sure that the variables in the new analysis were included when building the original SAS data set.

```
+--------------------------------------------------------------+
|                                                              |
|        MULTIVARIATE ACCOMMODATION MODELS                     |
|                                                              |
|                                                              |
|                                                              |
|    NAME OF THIS ANALYSIS (8 CHARS MAX):   FLYERS67           |
|                                                              |
|                                                              |
|    Enter VAX USERNAME for Directory Specification:  GZEHNER  |
|                                                              |
|                                                              |
|                                                              |
|                                                              |
+--------------------------------------------------------------+
```

8.2 <u>MASTER MENU</u>

The master menu presents options available to the user. The option requested is highlighted and selected by letter or by using the up and down arrow keys as input. A carriage return is entered when selection is complete.

The derive sample option generates a sample population needed to perform a multivariate analysis. Once the sample exists, a factor and model point analysis may be done.

MULTIVARIATE ACCOMMODATION MODELS

(A) DERIVE SAMPLE

(B) FACTOR AND MODEL POINT ANALYSIS

(X) EXIT PROGRAM

SELECT OPTION BY LETTER OR ARROWS AND PRESS <RETURN>

8.2.1 DERIVE SAMPLE

The derive sample menu displays the active surveys and selection is made by entering the requested survey number. The existing survey populations selection includes Air Force, Army, and Navy population anthropometric survey data. A description of these surveys may be found by accessing the list surveys option in the General Analysis Package.

DERIVE SAMPLE

	SURVEY	SURVEY TITLE
(A)	1	AIR FORCE WOMEN 1968 NONRATED
(B)	6	AIR FORCE WOMEN 1968 PILOT SUBSET
(C)	2	AIR FORCE MEN PILOTS 1967
(D)	3	AIR FORCE MEN 1965 NONRATED
(E)	4	ARMY MEN 1966
(F)	5	ARMY WOMEN 1977
(G)	7	ARMY MEN 1977 SUBSET

ACCESS DATA FOR WHICH SURVEY?

ENTER SURVEY NUMBER: 1

Data may be processed in metric or English units. Units must remain consistent throughout the analysis. This is especially important when specifying data values for selection criteria input.

**MEASUREMENT DATA STATISTICS
BY SURVEY**

DATA REQUESTED IN UNIT TYPE:

(A) METRIC UNITS

(B) ENGLISH UNITS

(NOTE: CRITERIA INPUT MUST BE IN SAME UNITS CHOSEN)

Once the population has been selected, the rest of the SAS job is built. A procedure file will be created to run a SAS job which creates the data set requested. This procedure file uses the name of the analysis specified at the beginning of the session with the file extension .SAS, e.g. FLYERS67.SAS. Selection criteria measurement data are automatically analyzed by SAS and the option to analyze up to 10 additional measurement variables is available. These are entered by measurement number or title.

DERIVE SAMPLE

ENTER MEASUREMENTS TO BE INCLUDED IN DATA SET (MAX 30):

MEASUREMENT NUMBER OR TITLE: 867
MEASUREMENT NUMBER OR TITLE: 194
MEASUREMENT NUMBER OR TITLE: 678
MEASUREMENT NUMBER OR TITLE: SITTING-HT
MEASUREMENT NUMBER OR TITLE: 330
MEASUREMENT NUMBER OR TITLE: <RETURN>

New measurements may be derived from existing measurements taken in the survey selected. The user must be cautious about deriving new variables and should consult AL/CFHD on the validity of any derived variables. These new measurements may be derived and included in the SAS data set being built.

ANALYZE DATA USING SAS

Would you like to derive new variables? (Y or N):   Y

The user will be prompted for input to derive new variables. A maximum of five (5) new variables may be derived in a single SAS run. The maximum variable name length is eight (8). Special characters such as dashes and dollar signs should not be used in the variable name. Requested measurements and operators $(+, -, *, /, **)$ must be delimited with spaces to be processed correctly. Parentheses may be used for clarification. A carriage return with no entry on the new variable name line will exit this screen.

ANALYZE DATA USING SAS
DERIVE NEW VARIABLES (MAX 5)

New Variable Name to Create (Max 8 Chars):   SHSD
SHSD =   23 − (805 − 758)

This display screen supplies information on how to enter criteria input for SAS. The subset of survey data to extract is determined by these criteria.

SAS DATA SELECTION CRITERIA INPUT

Define the subset of subjects you would like data extracted for.
A maximum of 30 criterion are allowed. A "+" continues criteria input
to the next line. A maximum of 9 input lines is allowed. Criteria must
be entered in the units (metric or English) previously selected.
Comparison operators include:

<	or	LT	(less than)	<= or LE	(less than or equal to)
>	or	GT	(greater than)	>= or GE	(greater than or equal to)
=	or	EQ	(equal to)	NE	(not equal to)

Logical operators include:
& or AND (Logical AND) | or OR (logical OR) NOT (Logical NOT)

Parentheses may be used to clarify SAS input criteria.
For example, to select subject data where age is over 21 and up to and
including 25.5 with stature less that 170.0, your criteria input is:

CRITERIA: (AGE > 21 AND AGE <= 25.5) AND STATURE LT 170.0

Press <RETURN> to continue

Criteria are entered from this screen. If the entire sample set is to be included, a carriage return is entered with no input. Valid comparison and logical operators for input are displayed. Criteria measurement variables may be entered by measurement name or title. Criteria are checked for a valid sequence of input by the program but the logic of the command cannot be checked. This can result in the SAS procedure not finding any data which meet the criteria specified. Parentheses may be used to further clarify selection criteria and avoid confusion. Criteria may be entered across lines if a '+' is entered on the preceding line.

DERIVE SAMPLE

COMPARISON OPERATORS:

<	or	LT	(less)	<= or LE	(less or equal)
>	or	GT	(greater)	>= or GE	(greater or equal)
=	or	EQ	(equal)	NE	(not equal to)

LOGICAL OPERATORS:
   & or AND | or OR   NOT

PARENTHESES TO CLARIFY CRITERIA, + TO CONTINUE A LINE

CRITERIA:

CHECKING SAS DATA SET RESULTS

The SAS job has now been built and will be submitted to the system to execute. A message will be displayed while it is executing. This may take a few minutes depending on the size of the data set being built.

When the SAS job is complete, the VAX editor EDIT will be invoked and will display the SAS log file as shown in Figure 3. This file should be examined to make sure the run executed successfully and contained the expected results. Always check the number of observations placed in the SAS data set to verify your expectations of the number of people in the sample.

After you have checked out the log file, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'QUIT' to exit the editor.

EDITING THE SAS JOB

The next screen will ask the user if the SAS run was okay. A Y (yes) or a N (no) is entered. When a No is entered, the user will be asked if the SAS procedure is to be edited. If this is desired, the software will call the VAX editor and allow the user to edit the SAS job file. After the changes are made to the job file, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'EXIT' to exit the editor. This will save the changes made to the job file. The software will resubmit the new SAS job and proceed as before in verifying the results.

```
                    SAS   L O G    VMS SAS 5.18

Copyright (c) 1984,1986,1987,1988 SAS Institute Inc., Cary, N.C. 27512, U.S.A.
NOTE: VMS SAS Production Release 5.18 WRIGHT-PATTERSON AIR FORCE BASE/AFAMRL
NOTE: LICENSED CPUID MODEL = VAX 8650, SERIAL = 0483C7C9.

     1   LIBNAME APDATA ''ANTHRO$DISK:[APDATA]'';
     2   LIBNAME HOMEDIR ''[GZEHNER]'';
     3   DATA HOMEDIR.FLYERS67;
     4   SET APDATA.AFM67
     5   (KEEP=M867 M194 M678 M758 M330 M23 M805 M758 );
     6   SHSD     = M23 - ( M805 -   M758);
     7   LABEL M867=''THUMB-TIP-REACH'';
     8   LABEL M194=''BUTTOCK-KNEE-LTH'';
     9   LABEL M678=''POPLITEAL-HT-SIT'';
    10   LABEL M758=''SITTING-HT'';
    11   LABEL M330=''EYE-HT-SIT'';
    12   LABEL M23=''ACROMION-HT'';
    13   LABEL M805=''STATURE'';
    14   LABEL M758=''SITTING-HT'';
    15   OPTIONS LINESIZE=75;
    16   RUN;
NOTE: THE DATA SET HOMEDIR.FLYERS67 HAS 2420 OBSERVATIONS AND 8 VARIABLES.
NOTE: THE DATA STEP USED 00:00:03.24 CPU SECONDS, 223 PAGEFAULTS.
NOTE: SAS INSTITUTE INC., SAS CIRCLE, BOX 8000, CARY, N. C., 27512-8000.
```

Figure 3. Derive Sample SAS Log, FLYERS67.LOG

8.2.2 FACTOR AND MODEL POINT ANALYSIS

FACTOR ANALYSIS

This part of the analysis assumes that a valid SAS data set has been built and is ready for access. The first screen prompts the user for the measurements to be included in the factor analysis. A maximum of 20 is allowed.

FACTOR ANALYSIS USING SAS

MEASUREMENTS TO INCLUDE IN THE FACTOR ANALYSIS (MAX 20)

MEASUREMENT NUMBER OR TITLE: 867
MEASUREMENT NUMBER OR TITLE: 194
MEASUREMENT NUMBER OR TITLE: 678
MEASUREMENT NUMBER OR TITLE: 758
MEASUREMENT NUMBER OR TITLE: 330
MEASUREMENT NUMBER OR TITLE: SHSD
MEASUREMENT NUMBER OR TITLE: <RETURN>

The SAS job has now been built and will be submitted to the system to execute. The SAS job file name for this is F<analysis name>.SAS, e.g. FFLYERS67.SAS. A message will be displayed while it is executing. This may take a few minutes depending on the number of variables included in the analysis.

The SAS log file will be displayed to
allow you to review the run. You will
be in the VAX EDT editor. You must enter
<cntrl-Z> and QUIT to continue.

CHECKING SAS FACTOR ANALYSIS RESULTS

When the SAS job is complete, the VAX editor will be invoked and will display the SAS log file as shown in Figure 4. This file should be examined to make sure the run executed successfully and contained no errors. After you have checked out the log file, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'QUIT' to exit the editor.

```
                    S A S   L O G    VMS SAS 5.18
Copyright (c) 1984,1986,1987,1988 SAS Institute Inc., Cary, N.C. 27512, U.S.A.
NOTE: VMS SAS Production Release 5.18 WRIGHT-PATTERSON AIR FORCE BASE/AFAMRL

     1  LIBNAME HOMEDIR ''[GZEHNER]'';
     2  PROC FACTOR DATA=HOMEDIR.FLYERS67
     3  (KEEP=
     4  M867 M194 M678 M758 M330 SHSD )
     5  OUTSTAT = HOMEDIR.FACTOR CORR EIGENVECTORS SCORE SIMPLE
     6  MINEIGEN=0 ROTATE=NONE;
     7  TITLE; OPTIONS NODATE LINESIZE=78;
NOTE: THE DATA SET HOMEDIR.FACTOR HAS 24 OBSERVATIONS AND 8 VARIABLES.
NOTE: THE PROCEDURE FACTOR USED 00:00:01.77 CPU SECONDS, 301 PAGEFAULTS.
     8  DATA OUT;
     9  SET HOMEDIR.FLYERS67; FILE SURVEY NOPRINT PS=600;
    10  PUT
    11  M867 M194 M678 M758 M330 SHSD ;
NOTE: FILE SURVEY IS FILE HEG$DISK:[GZEHNER]SURVEY.DAT.
NOTE: 2420 LINES WERE WRITTEN TO FILE SURVEY.
NOTE: THE DATA SET WORK.OUT HAS 2420 OBSERVATIONS AND 8 VARIABLES.
    12  DATA HOMEDIR.;
    13  SET HOMEDIR.FACTOR;
    14  IF _TYPE_=''N'' OR _TYPE_=''MEAN'' OR _TYPE_=''STD''
    15  OR _TYPE_ = ''PATTERN'' OR _TYPE_ = ''SCORE'';
    16  IF (_TYPE_  = ''MEAN'') THEN DATATYPE=1;
    17  ELSE IF (_TYPE_ = ''STD'') THEN DATATYPE=2;
    18  ELSE IF (_TYPE_=''PATTERN'') THEN DATATYPE=3;
    19  ELSE IF (_TYPE_ =''SCORE'') THEN DATATYPE=4;
    20  ELSE IF (_TYPE_ = ''N'') THEN DATATYPE=5;
    21  FORMAT
    22  M867 M194 M678 M758 M330 SHSD 7.5;
    23  RUN;
NOTE: THE DATA SET HOMEDIR.FACOUT HAS 15 OBSERVATIONS AND 9 VARIABLES.
NOTE: THE DATA STEP USED 00:00:00.61 CPU SECONDS, 11 PAGEFAULTS.
```

Figure 4. SAS Factor Analysis Log, FFLYERS67.LOG

```
24  DATA TEMP;
25  SET HOMEDIR.FACOUT;
26  FILE METDAT NOPRINT PS=500;
27     PUT '867' @10 DATATYPE _NAME_  M867 F13.5;
28     PUT '194' @10 DATATYPE _NAME_  M194 F13.5;
29     PUT '678' @10 DATATYPE _NAME_  M678 F13.5;
30     PUT '758' @10 DATATYPE _NAME_  M758 F13.5;
31     PUT '330' @10 DATATYPE _NAME_  M330 F13.5;
32     PUT 'SHSD' @10 DATATYPE _NAME_  SHSD F13.5;
NOTE: FILE METDAT IS FILE HEG$DISK:[GZEHNER]METDAT.DAT.
NOTE: 90 LINES WERE WRITTEN TO FILE METDAT.
NOTE: THE DATA SET WORK.TEMP HAS 15 OBSERVATIONS AND 9 VARIABLES.
NOTE: THE DATA STEP USED 00:00:00.64 CPU SECONDS, 38 PAGEFAULTS.
```

Figure 4. SAS Factor Analysis Log, FFLYERS67.LOG (cont.)

EDITING THE SAS FACTOR ANALYSIS JOB

The next screen will ask the user if the SAS run was correct. When a No is entered, the user will be asked if the SAS procedure is to be edited. If this is desired, the software will call the VAX editor and allow the user to edit the SAS job file. After the changes are made to the job file, enter a <**cntrl-Z**> which brings you to the '*' prompt in the editor. Enter '**EXIT**' to exit the editor. This will save the changes made to the job file. The software will resubmit the new SAS job and proceed as before in verifying the results.

If the SAS factor analysis ran correctly, the software will call the VAX editor and allow the user to see the output results of the SAS run as shown in Figure 5. The file name for the SAS results file is F<analysis name>.LIS, e.g. FFLYERS67.LIS. The output includes simple statistics (means and standard deviations), correlations, eigenvalues, eigenvectors, and factor patterns. Here the user may decide to declare a minimum eigenvalue in the analysis or to rotate the principal components.

After you have checked out the results, enter a <**cntrl-Z**> which brings you to the '*' prompt in the editor. Enter '**QUIT**' to exit the editor. The user will be asked if a hard copy of the output is requested. The software will send a hard copy to the user's default printer if requested.

MEANS AND STANDARD DEVIATIONS FROM   2420 OBSERVATIONS

	M867	M194	M678
MEAN	80.3076	60.4034	43.7021
STD DEV	3.98091	2.70288	2.24642

	M758	M330	SHSD
MEAN	93.1838	80.9497	61.0511
STD DEV	3.17631	3.01688	2.86186

CORRELATIONS

	M867	M194	M678	
M867	1.00000	0.60506	0.64683	THUMB-TIP-REACH
M194	0.60506	1.00000	0.64440	BUTTOCK-KNEE-LTH
M678	0.64683	0.64440	1.00000	POPLITEAL-HT-SIT
M758	0.41259	0.39236	0.48823	SITTING-HT
M330	0.39085	0.39062	0.44083	EYE-HT-SIT
SHSD	0.33734	0.36848	0.38322	

	M758	M330	SHSD	
M867	0.41259	0.39085	0.33734	THUMB-TIP-REACH
M194	0.39236	0.39062	0.36848	BUTTOCK-KNEE-LTH
M678	0.48823	0.44083	0.38322	POPLITEAL-HT-SIT
M758	1.00000	0.93065	0.83153	SITTING-HT
M330	0.93065	1.00000	0.78242	EYE-HT-SIT
SHSD	0.83153	0.78242	1.00000	

Figure 5. SAS Factor Analysis, FFLYERS67.LIS

INITIAL FACTOR METHOD: PRINCIPAL COMPONENTS

PRIOR COMMUNALITY ESTIMATES: ONE
EIGENVALUES OF THE CORRELATION MATRIX
TOTAL =   6   AVERAGE =   1

	1	2	3	4	5	6
EIGENVALUE	3.705620	1.261455	0.398904	0.342939	0.229984	0.061097
DIFFERENCE	2.444166	0.862551	0.055965	0.112955	0.168887	
PROPORTION	0.6176	0.2102	0.0665	0.0572	0.0383	0.0102
CUMULATIVE	0.6176	0.8278	0.8943	0.9515	0.9898	1.0000

6 FACTORS WILL BE RETAINED BY THE NFACTOR CRITERION
EIGENVECTORS

	1	2	3	
M867	0.36081	0.46133	-0.65443	THUMB-TIP-REACH
M194	0.36164	0.45464	0.73760	BUTTOCK-KNEE-LTH
M678	0.38786	0.41164	-0.07066	POPLITEAL-HT-SIT
M758	0.46044	-0.35621	-0.07556	SITTING-HT
M330	0.44738	-0.36567	-0.04437	EYE-HT-SIT
SHSD	0.42006	-0.38786	0.12245	

	4	5	6	
M867	0.47678	0.03704	0.00500	THUMB-TIP-REACH
M194	0.31021	-0.13871	-0.05475	BUTTOCK-KNEE-LTH
M678	-0.80201	0.15880	0.08174	POPLITEAL-HT-SIT
M758	-0.08035	-0.24582	-0.76715	SITTING-HT
M330	-0.01058	-0.53455	0.61507	EYE-HT-SIT
SHSD	0.16329	0.77974	0.15318	

FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3	
M867	0.69457	0.51814	-0.41333	THUMB-TIP-REACH
M194	0.69615	0.51063	0.46586	BUTTOCK-KNEE-LTH
M678	0.74664	0.46233	-0.04463	POPLITEAL-HT-SIT
M758	0.88634	-0.40007	-0.04772	SITTING-HT
M330	0.86120	-0.41070	-0.02803	EYE-HT-SIT
SHSD	0.80861	-0.43562	0.07734	

	FACTOR4	FACTOR5	FACTOR6	
M867	0.27920	0.01776	0.00124	THUMB-TIP-REACH
M194	0.18166	-0.06652	-0.01353	BUTTOCK-KNEE-LTH
M678	-0.46967	0.07616	0.02020	POPLITEAL-HT-SIT
M758	-0.04706	-0.11789	-0.18962	SITTING-HT
M330	-0.00619	-0.25635	0.15203	EYE-HT-SIT
SHSD	0.09563	0.37394	0.03786	

Figure 5. SAS Factor Analysis, FFLYERS67.LIS (cont.)

INITIAL FACTOR METHOD: PRINCIPAL COMPONENTS

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6
3.705620	1.261455	0.398904	0.342939	0.229984	0.061097

FINAL COMMUNALITY ESTIMATES: TOTAL =   6.000000

M867	M194	M678	M758	M330	SHSD
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

SCORING COEFFICIENTS ESTIMATED BY REGRESSION

SQUARED MULTIPLE CORRELATIONS OF THE VARIABLES WITH EACH FACTOR

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

STANDARDIZED SCORING COEFFICIENTS

	FACTOR1	FACTOR2	FACTOR3	
M867	0.18744	0.41074	-1.03617	THUMB-TIP-REACH
M194	0.18786	0.40480	1.16785	BUTTOCK-KNEE-LTH
M678	0.20149	0.36650	-0.11188	POPLITEAL-HT-SIT
M758	0.23919	-0.31715	-0.11963	SITTING-HT
M330	0.23240	-0.32558	-0.07026	EYE-HT-SIT
SHSD	0.21821	-0.34533	0.19387	

	FACTOR4	FACTOR5	FACTOR6	
M867	0.81415	0.07723	0.02024	THUMB-TIP-REACH
M194	0.52971	-0.28923	-0.22148	BUTTOCK-KNEE-LTH
M678	-1.36953	0.33114	0.33068	POPLITEAL-HT-SIT
M758	-0.13721	-0.51259	-3.10363	SITTING-HT
M330	-0.01806	-1.11465	2.48836	EYE-HT-SIT
SHSD	0.27884	1.62593	0.61973	

Figure 5. SAS Factor Analysis, FFLYERS67.LIS (cont.)

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ADJUSTING MINEIGEN AND ROTATION

The option to EDIT and RESUBMIT the SAS factor analysis job will be given. If it is decided that a minimum eigenvalue is desired or that the principal components should be rotated, answer Yes to edit the job. The software will invoke the VAX editor and allow editing of the SAS factor analysis job file. Look for the entry MINEIGEN = 0 and substitute the new mineigen value for 0. The ROTATE = NONE entry may be substituted by a new rotation method, e.g. VARIMAX.

After the changes are made to the job file, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'EXIT' to exit the editor and save the changes made. The software will resubmit the new SAS job and proceed as before in verifying the results.

MODEL POINT ANALYSIS

When the SAS factor analysis has been verified, the user is ready to execute the Model Point code. The number of principal components is entered, currently the only valid responses are 2, 3, (two- or three- dimensional problems are allowed) or X to exit. The number of variables in the analysis and the title to appear on analysis output are entered. The Model Point Analysis is then executed.

MULTIVARIATE ACCOMMODATION MODELS

Number of principal components <2, 3 or X (exit)>:   2

Number of variables in this analysis: 6

Title to appear on analysis output <max 70 chars>:
1967 USAF MALE PILOTS

Performing Model Point Analysis

When the model point analysis is complete, the software will invoke the VAX editor which allows the user to look at the results from the model point routine as shown in Figure 6. The model point output file is <analysis name>.OUT, e.g. FLYERS67.OUT. Data includes simple statistics, factor patterns, and the models developed with z-scores, percentiles, and measurement values.

After you have checked out the results, enter a <cntrl-Z> which brings you to the '*' prompt in the editor. Enter 'QUIT' to exit the editor.

EXIT MULTIVARIATE ANALYSIS

Users logged into their VAX accounts will then be asked if a hard copy printout is needed. If the user answers yes, the printout will be sent to the user's default printer. The software returns to the Main Menu to allow for further analysis.

Users running from the account ANTHRO will see the message:

Cleaning up file space ... Please wait.

Temporary file space on the FALCON is being reclaimed at the time. When the message:

"ANTHRO System finished. Exiting system . ."

DSS:DISCONNECTED

is displayed, the FALCON VAX has been disconnected from the data switch and the connection may be terminated.

```
                        1967 USAF MALE PILOTS
        99.5% ACCOMMODATION FOR  6 VARIABLES AND 2 PRINCIPAL COMPONENTS
                   FLYERS67 N=   2420  RADIUS= 3.326


        VARIABLE                        MEAN     STD DEV

THUMB-TIP-REACH                        80.308    3.981
BUTTOCK-KNEE-LTH                       60.403    2.703
POPLITEAL-HT-SIT                       43.702    2.246
SITTING-HT                             93.184    3.176
EYE-HT-SIT                             80.950    3.017
SHSD                                   61.051    2.862


                A(i,j) FACTOR CORRELATION MATRIX


                                  FAC1       FAC2

 THUMB-TIP-REACH                 0.69457    0.51814
 BUTTOCK-KNEE-LTH                0.69615    0.51063
 POPLITEAL-HT-SIT               0.74664    0.46233
 SITTING-HT                     0.88634   -0.40007
 EYE-HT-SIT                     0.86120   -0.41070
 SHSD                           0.80861   -0.43562


            VARIABLE Z-SCORES FOR ''2-D MAN" MODEL POINTS


                            A       B       C       D

THUMB-TIP-REACH           2.852  -0.415  -2.852   0.415
BUTTOCK-KNEE-LTH          2.838  -0.436  -2.838   0.436
POPLITEAL-HT-SIT          2.843  -0.669  -2.843   0.669
SITTING-HT                1.144  -3.025  -1.144   3.025
EYE-HT-SIT                1.060  -2.991  -1.060   2.991
SHSD                      0.877  -2.926  -0.877   2.926


                            W       X       Y       Z

THUMB-TIP-REACH           2.310   1.723  -2.310  -1.723
BUTTOCK-KNEE-LTH          2.315   1.698  -2.315  -1.698
POPLITEAL-HT-SIT          2.483   1.538  -2.483  -1.538
SITTING-HT                2.948  -1.331  -2.948   1.331
EYE-HT-SIT                2.864  -1.366  -2.864   1.366
SHSD                      2.689  -1.449  -2.689   1.449
```

Figure 6. Model Point Results (FLYERS67.OUT)

1967 USAF MALE PILOTS
99.5% ACCOMMODATION FOR 6 VARIABLES AND 2 PRINCIPAL COMPONENTS

PERCENTILE VALUES FOR ''2-D MAN" MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	100	34	0	66
BUTTOCK-KNEE-LTH	100	33	0	67
POPLITEAL-HT-SIT	100	25	0	75
SITTING-HT	87	0	13	100
EYE-HT-SIT	86	0	14	100
SHSD	81	0	19	100

	W	X	Y	Z
THUMB-TIP-REACH	99	96	1	4
BUTTOCK-KNEE-LTH	99	96	1	4
POPLITEAL-HT-SIT	99	94	1	6
SITTING-HT	100	9	0	91
EYE-HT-SIT	100	9	0	91
SHSD	100	7	0	93

VARIABLE VALUES FOR ''2-D MAN" MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	91.66	78.66	68.95	81.96
BUTTOCK-KNEE-LTH	68.07	59.22	52.73	61.58
POPLITEAL-HT-SIT	50.09	42.20	37.32	45.20
SITTING-HT	96.82	83.58	89.55	102.79
EYE-HT-SIT	84.15	71.93	77.75	89.97
SHSD	63.56	52.68	58.54	69.43

	W	X	Y	Z
THUMB-TIP-REACH	89.50	87.17	71.11	73.45
BUTTOCK-KNEE-LTH	66.66	64.99	54.14	55.81
POPLITEAL-HT-SIT	49.28	47.16	38.12	40.25
SITTING-HT	102.55	88.96	83.82	97.41
EYE-HT-SIT	89.59	76.83	72.31	85.07
SHSD	68.75	56.90	53.35	65.20

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

```
                    1967 USAF MALE PILOTS
        98.0% ACCOMMODATION FOR  6 VARIABLES AND 2 PRINCIPAL COMPONENTS
                FLYERS67 N=   2420  RADIUS= 2.926


            VARIABLE                    MEAN      STD DEV


    THUMB-TIP-REACH                     80.308     3.981
    BUTTOCK-KNEE-LTH                    60.403     2.703
    POPLITEAL-HT-SIT                    43.702     2.246
    SITTING-HT                          93.184     3.176
    EYE-HT-SIT                          80.950     3.017
    SHSD                                61.051     2.862


                A(i,j) FACTOR CORRELATION MATRIX


                                    FAC1       FAC2


    THUMB-TIP-REACH                 0.69457    0.51814
    BUTTOCK-KNEE-LTH                0.69615    0.51063
    POPLITEAL-HT-SIT                0.74664    0.46233
    SITTING-HT                      0.88634   -0.40007
    EYE-HT-SIT                      0.86120   -0.41070
    SHSD                            0.80861   -0.43562


            VARIABLE Z-SCORES FOR ''2-D MAN" MODEL POINTS


                            A       B       C       D


    THUMB-TIP-REACH       2.509  -0.365  -2.509   0.365
    BUTTOCK-KNEE-LTH      2.497  -0.384  -2.497   0.384
    POPLITEAL-HT-SIT      2.501  -0.588  -2.501   0.588
    SITTING-HT            1.006  -2.662  -1.006   2.662
    EYE-HT-SIT           0.932   -2.632  -0.932   2.632
    SHSD                 0.772   -2.574  -0.772   2.574


                            W       X       Y       Z


    THUMB-TIP-REACH       2.032   1.516  -2.032  -1.516
    BUTTOCK-KNEE-LTH      2.037   1.494  -2.037  -1.494
    POPLITEAL-HT-SIT      2.185   1.353  -2.185  -1.353
    SITTING-HT            2.593  -1.171  -2.593   1.171
    EYE-HT-SIT           2.520   -1.202  -2.520   1.202
    SHSD                 2.366   -1.275  -2.366   1.275
```

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

1967 USAF MALE PILOTS
98.0% ACCOMMODATION FOR 6 VARIABLES AND 2 PRINCIPAL COMPONENTS

PERCENTILE VALUES FOR ''2-D MAN'' MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	99	36	1	64
BUTTOCK-KNEE-LTH	99	35	1	65
POPLITEAL-HT-SIT	99	28	1	72
SITTING-HT	84	0	16	100
EYE-HT-SIT	82	0	18	100
SHSD	78	1	22	99

	W	X	Y	Z
THUMB-TIP-REACH	98	94	2	6
BUTTOCK-KNEE-LTH	98	93	2	7
POPLITEAL-HT-SIT	99	91	1	9
SITTING-HT	100	12	0	88
EYE-HT-SIT	99	11	1	89
SHSD	99	10	1	90

VARIABLE VALUES FOR ''2-D MAN'' MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	90.30	78.85	70.32	81.76
BUTTOCK-KNEE-LTH	67.15	59.37	53.65	61.44
POPLITEAL-HT-SIT	49.32	42.38	38.08	45.02
SITTING-HT	96.38	84.73	89.99	101.64
EYE-HT-SIT	83.76	73.01	78.14	88.89
SHSD	63.26	53.68	58.84	68.42

	W	X	Y	Z
THUMB-TIP-REACH	88.40	86.34	72.22	74.27
BUTTOCK-KNEE-LTH	65.91	64.44	54.90	56.36
POPLITEAL-HT-SIT	48.61	46.74	38.80	40.66
SITTING-HT	101.42	89.47	84.95	96.90
EYE-HT-SIT	88.55	77.32	73.35	84.58
SHSD	67.82	57.40	54.28	64.70

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

```
                        1967 USAF MALE PILOTS
            95.0% ACCOMMODATION FOR  6 VARIABLES AND 2 PRINCIPAL COMPONENTS
                       FLYERS67 N=   2420  RADIUS= 2.460


                VARIABLE                    MEAN      STD DEV


        THUMB-TIP-REACH                     80.308     3.981
        BUTTOCK-KNEE-LTH                    60.403     2.703
        POPLITEAL-HT-SIT                    43.702     2.246
        SITTING-HT                          93.184     3.176
        EYE-HT-SIT                          80.950     3.017
        SHSD                                61.051     2.862


                    A(i,j) FACTOR CORRELATION MATRIX


                                         FAC1       FAC2


        THUMB-TIP-REACH                  0.69457    0.51814
        BUTTOCK-KNEE-LTH                 0.69615    0.51063
        POPLITEAL-HT-SIT                 0.74664    0.46233
        SITTING-HT                       0.88634   -0.40007
        EYE-HT-SIT                       0.86120   -0.41070
        SHSD                             0.80861   -0.43562


                VARIABLE Z-SCORES FOR ''2-D MAN" MODEL POINTS


                                     A       B       C       D


        THUMB-TIP-REACH            2.109  -0.307  -2.109   0.307
        BUTTOCK-KNEE-LTH           2.099  -0.323  -2.099   0.323
        POPLITEAL-HT-SIT           2.103  -0.495  -2.103   0.495
        SITTING-HT                 0.846  -2.238  -0.846   2.238
        EYE-HT-SIT                 0.784  -2.212  -0.784   2.212
        SHSD                       0.649  -2.164  -0.649   2.164


                                     W       X       Y       Z


        THUMB-TIP-REACH            1.709   1.275  -1.709  -1.275
        BUTTOCK-KNEE-LTH           1.713   1.256  -1.713  -1.256
        POPLITEAL-HT-SIT           1.837   1.137  -1.837  -1.137
        SITTING-HT                 2.180  -0.984  -2.180   0.984
        EYE-HT-SIT                 2.119  -1.010  -2.119   1.010
        SHSD                       1.989  -1.072  -1.989   1.072
```

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

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1967 USAF MALE PILOTS
95.0% ACCOMMODATION FOR 6 VARIABLES AND 2 PRINCIPAL COMPONENTS

PERCENTILE VALUES FOR ''2-D MAN'' MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	98	38	2	62
BUTTOCK-KNEE-LTH	98	37	2	63
POPLITEAL-HT-SIT	98	31	2	69
SITTING-HT	80	1	20	99
EYE-HT-SIT	78	1	22	99
SHSD	74	2	26	98

	W	X	Y	Z
THUMB-TIP-REACH	96	90	4	10
BUTTOCK-KNEE-LTH	96	90	4	10
POPLITEAL-HT-SIT	97	87	3	13
SITTING-HT	99	16	1	84
EYE-HT-SIT	98	16	2	84
SHSD	98	14	2	86

VARIABLE VALUES FOR ''2-D MAN'' MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	88.71	79.09	71.91	81.53
BUTTOCK-KNEE-LTH	66.08	59.53	54.73	61.28
POPLITEAL-HT-SIT	48.43	42.59	38.98	44.81
SITTING-HT	95.87	86.08	90.50	100.29
EYE-HT-SIT	83.31	74.28	78.59	87.62
SHSD	62.91	54.86	59.19	67.25

	W	X	Y	Z
THUMB-TIP-REACH	87.11	85.38	73.51	75.23
BUTTOCK-KNEE-LTH	65.03	63.80	55.77	57.01
POPLITEAL-HT-SIT	47.83	46.26	39.58	41.15
SITTING-HT	100.11	90.06	86.26	96.31
EYE-HT-SIT	87.34	77.90	74.56	84.00
SHSD	66.74	57.98	55.36	64.12

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

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                    1967 USAF MALE PILOTS
     90.0% ACCOMMODATION FOR  6 VARIABLES AND 2 PRINCIPAL COMPONENTS
              FLYERS67 N=   2420  RADIUS= 2.143


          VARIABLE              MEAN     STD DEV


THUMB-TIP-REACH                80.308     3.981
BUTTOCK-KNEE-LTH               60.403     2.703
POPLITEAL-HT-SIT               43.702     2.246
SITTING-HT                     93.184     3.176
EYE-HT-SIT                     80.950     3.017
SHSD                           61.051     2.862


            A(i,j) FACTOR CORRELATION MATRIX


                                FAC1      FAC2


  THUMB-TIP-REACH              0.69457   0.51814
  BUTTOCK-KNEE-LTH             0.69615   0.51063
  POPLITEAL-HT-SIT             0.74664   0.46233
  SITTING-HT                   0.88634  -0.40007
  EYE-HT-SIT                   0.86120  -0.41070
  SHSD                         0.80861  -0.43562


       VARIABLE Z-SCORES FOR ''2-D MAN'' MODEL POINTS


                          A       B       C       D


THUMB-TIP-REACH          1.838  -0.267  -1.838   0.267
BUTTOCK-KNEE-LTH         1.829  -0.281  -1.829   0.281
POPLITEAL-HT-SIT         1.832  -0.431  -1.832   0.431
SITTING-HT               0.737  -1.949  -0.737   1.949
EYE-HT-SIT               0.683  -1.927  -0.683   1.927
SHSD                     0.565  -1.886  -0.565   1.886


                          W       X       Y       Z


THUMB-TIP-REACH          1.489   1.110  -1.489  -1.110
BUTTOCK-KNEE-LTH         1.492   1.094  -1.492  -1.094
POPLITEAL-HT-SIT         1.600   0.991  -1.600  -0.991
SITTING-HT               1.900  -0.857  -1.900   0.857
EYE-HT-SIT               1.846  -0.880  -1.846   0.880
SHSD                     1.733  -0.934  -1.733   0.934
```

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

1967 USAF MALE PILOTS
90.0% ACCOMMODATION FOR 6 VARIABLES AND 2 PRINCIPAL COMPONENTS

PERCENTILE VALUES FOR ''2-D MAN'' MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	97	39	3	61
BUTTOCK-KNEE-LTH	97	39	3	61
POPLITEAL-HT-SIT	97	33	3	67
SITTING-HT	77	3	23	97
EYE-HT-SIT	75	3	25	97
SHSD	71	3	29	97

	W	X	Y	Z
THUMB-TIP-REACH	93	87	7	13
BUTTOCK-KNEE-LTH	93	86	7	14
POPLITEAL-HT-SIT	95	84	5	16
SITTING-HT	97	20	3	80
EYE-HT-SIT	97	19	3	81
SHSD	96	18	4	82

VARIABLE VALUES FOR ''2-D MAN'' MODEL POINTS

	A	B	C	D
THUMB-TIP-REACH	87.62	79.24	72.99	81.37
BUTTOCK-KNEE-LTH	65.35	59.64	55.46	61.16
POPLITEAL-HT-SIT	47.82	42.73	39.59	44.67
SITTING-HT	95.52	86.99	90.84	99.38
EYE-HT-SIT	83.01	75.13	78.89	86.77
SHSD	62.67	55.65	59.43	66.45

	W	X	Y	Z
THUMB-TIP-REACH	86.23	84.73	74.38	75.89
BUTTOCK-KNEE-LTH	64.44	63.36	56.37	57.45
POPLITEAL-HT-SIT	47.30	45.93	40.11	41.48
SITTING-HT	99.22	90.46	87.15	95.91
EYE-HT-SIT	86.52	78.29	75.38	83.61
SHSD	66.01	58.38	56.09	63.72

Figure 6. Model Point Results (FLYERS67.OUT) (cont.)

MODIFICATION OF MODEL POINTS

The two-dimensional model points calculated encompass a specific percentage of the population since they reside on the circumference of the accommodation circle as shown in Figure 7. In some cases, these points need to be modified from the original circle due to variable restrictions, e.g. sitting height. New points may need to be calculated to meet these restrictions. The method of calculation for the new points is determined by the position of the model on the accommodation circle.
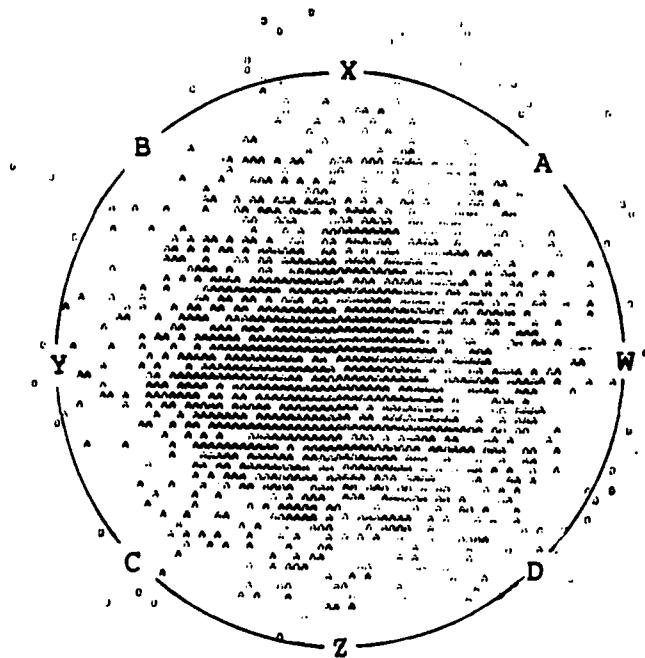

Figure 7. Accommodation Circle

The method for calculation for new model points is determined by the position of the model point on the accommodation circle. Points on the circle axes (models W, X, Y, and Z) are calculated using radius values while midquadrant models (A, B, C, and D) use component values. In the following discussion FAC1 and FAC2 represent correlation matrix factors as shown on the accommodation model output.

MODELS A, B, C, and D

1. Calculate z-score for new variable value.

$$zscore = \frac{newvalue - mean}{stddev}$$

2. Calculate component value.

$$component = \frac{zscore}{factor}$$

Factor is determined using the factor correlation matrix and the position of the model on the accommodation circle.

$$Model \quad A: \quad factor \quad = \quad fac1 \quad + \quad fac2$$
$$Model \quad B: \quad factor \quad = \quad -fac1 \quad + \quad fac2$$
$$Model \quad C: \quad factor \quad = \quad -fac1 \quad - \quad fac2$$
$$Model \quad D: \quad factor \quad = \quad fac1 \quad - \quad fac2$$

3. Calculate z-scores for each variable in model point.

$$zscore = factor * component$$

4. Calculate variable values for model point.

$$newvalue = mean + (zscore * stddev)$$

MODELS W, X, Y, AND Z

1. Calculate z-score for new variable value.

$$zscore = \frac{newvalue - mean}{stddev}$$

2. Calculate radius value.

$$radius = \frac{zscore}{factor}$$

Factor is determined using the factor correlation matrix and the position of the model on the accommodation circle.

$$
\begin{aligned}
Model \quad W: \quad factor \quad &= \quad fac1 \\
Model \quad X: \quad factor \quad &= \quad fac2 \\
Model \quad Y: \quad factor \quad &= \quad -fac1 \\
Model \quad Z: \quad factor \quad &= \quad -fac2
\end{aligned}
$$

3. Calculate z-scores for each variable in model point.

$$zscore = factor * radius$$

4. Calculate variable values for model point.

$$newvalue = mean + (zscore * stddev)$$

The following example uses a population with a sitting height restriction of 86.36 centimeters. The model point analysis output shown in Figure 8 shows model point sitting heights below the 86.36 centimeter restriction (C=83.19, Y=84.16, and Z=86.24). There is no need to test to these sitting height extremes since the sitting height restriction has already eliminated this portion of the population. The following calculations will bring these extremes to the minimum sitting height requirement and recalculate the other variables in the model. The corrected model points are shown in Figure 9.

MODIFY MODEL POINT C

Solve for new Component C using a minimum sitting height of 86.36.

1. Calculate z-score for sitting height.

$$zscore = \frac{value - mean}{stddev} = \frac{86.36 - 90.039}{2.562} = -1.436$$

2. Calculate Component.

$$Component = \frac{zscore}{-FAC1 - FAC2} = \frac{-1.436}{-.80827 - .52263} = 1.079$$

3. Calculate z-score for each variable in model point.

$zscore$	=	$(-FAC1 - FAC2)$	*	$Component$		
$zttreach$	=	$(-.66829 + .57047)$	*	1.079	=	$-.106$
$zbutknel$	=	$(-.67870 + .58624)$	*	1.079	=	$-.100$
$zpoplht$	=	$(-.72690 + .56289)$	*	1.079	=	$-.177$
$zsittht$	=	$(-.80827 - .52263)$	*	1.079	=	-1.436
$zeyehtst$	=	$(-.32576 - .45135)$	*	1.079	=	-1.378
$zshsd$	=	$(-.66197 - .59391)$	*	1.079	=	-1.355

4. Calculate variable values for model point.

x	=	$mean$	+	$(zscore$	*	$stddev)$		
$ttreach$	=	78.833	+	$(-0.106$	*	4.520)	=	78.35
$butknel$	=	60.497	+	$(-0.100$	*	2.967)	=	60.20
$poplht$	=	44.537	+	$(-0.177$	*	2.784)	=	44.04
$sittht$	=	90.939	+	$(-1.436$	*	2.562)	=	86.36
$eyehtst$	=	78.379	+	$(-1.378$	*	2.712)	=	74.64
$shsd$	=	58.203	+	$(-1.355$	*	2.582)	=	54.70

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MODIFY MODEL POINT Y

Solve for new Radius point Y using a minimum sitting height of 86.36.

1. Calculate radius using sitting height.

$$Radius = \frac{zscore}{-FAC1} = \frac{-1.436}{-.80827} = 1.777$$

2. Calculate z-score for each variable in model point.

$$
\begin{array}{lllll}
zscore & = & (-FAC1) & * & Radius \\
zttreach & = & (-.66829) & * & 1.777 & = & -1.188 \\
zbutknel & = & (-.67870) & * & 1.777 & = & -1.206 \\
zpoplht & = & (-.72690) & * & 1.777 & = & -1.292 \\
zsittht & = & (-.80827) & * & 1.777 & = & -1.436 \\
zeyehtst & = & (-.82576) & * & 1.777 & = & -1.467 \\
zshsd & = & (-.66197) & * & 1.777 & = & -1.176 \\
\end{array}
$$

3. Calculate variable values for model point.

$$
\begin{array}{lllllll}
x & = & mean & + & (zscore & * & stddev) \\
ttreach & = & 78.833 & + & (-1.188 & * & 4.520) & = & 73.47 \\
butknel & = & 60.497 & + & (-2.206 & * & 2.967) & = & 56.91 \\
poplht & = & 44.537 & + & (-1.292 & * & 2.784) & = & 40.93 \\
sittht & = & 90.939 & + & (-1.436 & * & 2.562) & = & 86.36 \\
eyehtst & = & 78.379 & + & (-1.467 & * & 2.712) & = & 74.39 \\
shsd & = & 58.203 & + & (-1.176 & * & 2.582) & = & 55.16 \\
\end{array}
$$

MODIFY MODEL POINT Z

Solve for new Radius point Z using a minimum sitting height of 86.36.

1. Calculate radius using sitting height.

$$Radius = \frac{zscore}{-FAC2} = \frac{-1.436}{-.52263} = 2.748$$

2. Calculate z-score for each variable in model point.

$$
\begin{array}{lclclcl}
zscore & = & (-FAC2) & * & Radius & & \\
zttreach & = & (.57047) & * & 2.748 & = & 1.569 \\
zbutknel & = & (.58624) & * & 2.748 & = & 1.612 \\
zpoplht & = & (.56289) & * & 2.748 & = & 1.548 \\
zsittht & = & (-.52263) & * & 2.748 & = & -1.436 \\
zeyehtst & = & (-.45135) & * & 2.748 & = & -1.241 \\
zshsd & = & (-.59391) & * & 2.748 & = & -1.633 \\
\end{array}
$$

3. Calculate variable values for model point.

$$
\begin{array}{lclclclcl}
x & = & mean & + & (zscore & * & stddev) & & \\
ttreach & = & 78.833 & + & (1.569 & * & 4.520) & = & 85.92 \\
butknel & = & 60.497 & + & (1.612 & * & 2.967) & = & 65.28 \\
poplht & = & 44.537 & + & (1.548 & * & 2.784) & = & 48.85 \\
sittht & = & 90.939 & + & (-1.436 & * & 2.562) & = & 86.36 \\
eyehtst & = & 78.379 & + & (-1.241 & * & 2.712) & = & 75.01 \\
shsd & = & 58.203 & + & (-1.633 & * & 2.582) & = & 53.99 \\
\end{array}
$$

AIR FORCE SAMPLE POPULATION
98.0% ACCOMMODATION FOR 6 VARIABLES AND 2 PRINCIPAL COMPONENTS
AFSAMP N = 2000 RADIUS = 2.839

VARIABLE	MEAN	STD DEV
TTREACH	78.833	4.520
BUTKNEL	60.497	2.967
POPLHT	44.537	2.784
SITTHT	90.039	2.562
EYEHTST	78.379	2.712
SHSD	58.203	2.582

A(i,j) FACTOR CORRELATION MATRIX

	FAC1	FAC2
TTREACH	0.66829	-0.57047
BUTKNEL	0.67870	-0.58624
POPLHT	0.72690	-0.56289
SITTHT	0.80827	0.52263
EYEHTST	0.82576	0.45135
SHSD	0.66197	0.59391

VARIABLE Z-SCORES FOR ''2-D MAN" MODEL POINTS

	A	B	C	D	W	X	Y	Z
TTREACH	0.196	-2.487	-0.196	2.487	1.897	-1.620	-1.897	1.620
BUTKNEL	0.186	-2.539	-0.186	2.539	1.927	-1.664	-1.927	1.664
POPLHT	0.329	-2.589	-0.329	2.589	2.064	-1.598	-2.064	1.598
SITTHT	2.672	-0.573	-2.672	0.573	2.295	1.484	-2.295	-1.484
EYEHTST	2.564	-0.752	-2.564	0.752	2.344	1.281	-2.344	-1.281
SHSD	2.521	-0.137	-2.521	0.137	1.879	1.686	-1.879	-1.686

VARIABLE VALUES (CM) FOR ''2-D MAN" MODEL POINTS

	A	B	C	D	W	X	Y	Z
TTREACH	79.72	67.59	77.95	90.07	87.41	71.51	70.26	86.15
BUTKNEL	61.05	52.96	59.95	68.03	66.21	55.56	54.78	65.44
POPLHT	45.45	37.33	43.62	51.75	50.28	40.09	38.79	48.99
SITTHT	96.88	88.57	83.19	91.51	95.92	93.84	84.16	86.24
EYEHTST	85.33	76.34	71.43	80.42	84.74	81.85	72.02	74.90
SHSD	64.71	57.85	51.69	58.56	63.06	62.56	53.35	53.85

Figure 8. Model Points without Sitting Height Restriction

```
AIR FORCE SAMPLE POPULATION MODIFIED WITH SIT-HT RESTRICTION
 98.0% ACCOMMODATION FOR  6 VARIABLES AND 2 PRINCIPAL COMPONENTS
               AFSAMP  N = 2000  RADIUS = 2.839
```

VARIABLE	MEAN	STD DEV
TTREACH	78.833	4.520
BUTKNEL	60.497	2.967
POPLHT	44.537	2.784
SITTHT	90.039	2.562
EYEHTST	78.379	2.712
SHSD	58.203	2.582

A(i,j) FACTOR CORRELATION MATRIX

	FAC1	FAC2
TTREACH	0.66829	-0.57047
BUTKNEL	0.67870	-0.58624
POPLHT	0.72690	-0.56289
SITTHT	0.80827	0.52263
EYEHTST	0.82576	0.45135
SHSD	0.66197	0.59391

VARIABLE Z-SCORES FOR ''2-D MAN" MODEL POINTS

	A	B	C*	D	W	X	Y*	Z*
TTREACH	0.196	-2.487	-0.106	2.487	1.897	-1.620	-1.188	1.569
BUTKNEL	0.186	-2.539	-0.100	2.539	1.927	-1.664	-1.206	1.612
POPLHT	0.329	-2.589	-0.177	2.589	2.064	-1.598	-1.292	1.548
SITTHT	2.672	-0.573	-1.436	0.573	2.295	1.484	-1.436	-1.436
EYEHTST	2.564	-0.752	-1.378	0.752	2.344	1.281	-1.467	-1.241
SHSD	2.521	-0.137	-1.355	0.137	1.879	1.686	-1.176	-1.633

VARIABLE VALUES (CM) FOR ''2-D MAN" MODEL POINTS

	A	B	C*	D	W	X	Y*	Z*
TTREACH	79.72	67.59	78.35	90.07	87.41	71.51	73.47	85.92
BUTKNEL	61.05	52.96	60.20	68.03	66.21	55.56	56.91	65.28
POPLHT	45.45	37.33	44.04	51.75	50.28	40.09	40.93	48.85
SITTHT	96.88	88.57	86.36	91.51	95.92	93.84	86.36	86.36
EYEHTST	85.33	76.34	74.64	80.42	84.74	81.85	74.39	75.01
SHSD	64.71	57.85	54.70	58.56	63.06	62.56	55.16	53.99

*Points modified from original symmetric ellipse due to sitting height restrictions: New radii; for Z, 2.748; for Y, 1.777; New component for C, 1.079.

Figure 9. Model Points Modified with Sitting Height Restriction

8.0 ERROR REPORTING

When a system error is encountered, a message will be broadcast on the terminal specifying a RIM ERROR if the error was detected within the database, or a FILE ERROR if the error resulted from a file i/o operation. The error number and the routine in which the error was encountered will also be displayed. All error information should be noted and reported to AL/CFHD.

APPENDIX A

MEASUREMENT NUMBERS AND TITLES
January 1992

NUMBER	MEASUREMENT TITLE
6	ABDOMINAL-DEPTH-SIT
8	ABDOMINAL-EXT-CIRC
10	ABDOMINAL-EXT-DEPTH
18	ABDOMINAL-EXT-HT
23	ACROMION-HT
25	ACROMION-HT-SIT
39	ACROMION-RADIALE-LTH
42	ACROMION-TO-BICEPS-CIRC-LEVEL
48	AGE
58	ANKLE-CIRC
64	ANKLE-HT
70	ARM-CIRC-AXILLARY
72	ARM-CIRC-BICEPS-RELAXED
73	ARM-CIRC-BICEPS-RELAXED-LEFT
77	ARM-CIRC-BICEPS-FLEXED
78	ARM-CIRC-BICEPS-FLEXED-LEFT
90	AXILLA-HT
91	AXILLA-TO-WAIST
93	BACK-ARC-AT-BUST
95	BACK-ARC-AT-WAIST
103	BIACROMIAL-BRTH
110	BICEPS-SKF
122	BIDELTOID-BRTH
126	BIGONIAL-BRTH
130	BIILIOCRISTALE-BRTH
134	BIMALLEOLAR-BRTH
138	BIOCULAR-BRTH
140	BISPINOUS-BRTH
142	BITRAGION-BRTH
144	BITRAGION-CORONAL-ARC
146	BITRAGION-CRINION-ARC
150	BITRAGION-MENTON-ARC
152	BITRAGION-MINIMUM-FRONTAL-ARC
153	BITRAGION-POSTERIOR-ARC
154	BITRAGION-NUCHALE-ARC
156	BITRAGION-SUBMANDIBULAR-ARC
158	BITRAGION-SUBNASALE-ARC
161	BITROCHANTERION-BRTH

165	BIZYGOMATIC-BRTH
167	BODY-LTH-SUPINE-KNEES-FLEXED
169	BOWED-TORSO-HT
172	BUSTPOINT-TO-BUSTPOINT-BRTH
185	BUTTOCK-CURVATURE
187	BUTTOCK-HEEL-LTH
188	BUTTOCK-HT
194	BUTTOCK-KNEE-LTH
195	BUTTOCK-KNEE-LTH-BUTTPLATE
200	BUTTOCK-POPLITEAL-LTH
207	CALF-CIRC
209	CALF-CIRC-LEFT
215	CALF-HT
219	CERVICALE-HT
220	CERVICALE-HT-SIT
223	CHEST-BRTH
227	CHEST-BRTH-BONE
230	CHEST-CIRC
231	CHEST-CIRC-AT-SCYE
232	CHEST-CIRC-BELOW-BUST
236	CHEST-DEPTH
237	CHEST-HT
249	CROTCH-HT
251	CROTCH-LTH-NATURAL-WAIST
252	CROTCH-LTH-UMBILICUS
253	CROTCH-LTH-POSTERIOR-NATURAL
254	CROTCH-LTH-POSTERIOR-OMPHALION
265	DACTYLION-HT
269	DELTOID-ARC
277	EAR-BRTH
280	EAR-LTH
282	EAR-LTH-ABOVE-TRAGION
285	EAR-PROTRUSION
286	EAR-TO-EAR-BRTH
293	ELBOW-BRTH-BONE
297	ELBOW-BRTH-BONE-LEFT
303	ELBOW-CIRC-EXTENDED
305	ELBOW-CIRC-FLEXED
307	ELBOW-GRIP-LTH
309	ELBOW-HT
312	ELBOW-REST-HT
313	ELBOW-REST-HT-STD
324	ELBOW-WRIST-LTH
326	EXTERNAL-CANTHUS-TO-OCCIPUT

500	INTEROCULAR-DIST
503	INTERPUPILLARY-DIST
506	INTERSCYE-DIST
507	INTERSCYE-DIST-MAX
508	INTERSCYE-DIST-MID
510	INTERSCYE-FRONT
511	JUXTANIPPLE-SKF
512	KNEE-BRTH-BONE
513	KNEE-BRTH-BONE-LEFT
515	KNEE-CIRC
517	KNEE-CIRC-SIT
528	KNEE-HT-FLEXED-SUPINE
529	KNEE-HT-SIT
536	KNEE-TO-KNEE-BRTH
538	KNEELING-HT
540	KNEELING-LEG-LTH
542	LATERAL-FEMORAL-EPICONDYLE-HT
543	LATERAL-MALLEOLUS-HT
547	LIP-LTH
549	LIP-LTH-SMILING
552	LIP-PROTRUSION-TO-OCCIPUT
555	LIP-TO-LIP-LTH
576	MEDIAL-CALF-SKF
579	MEDIAL-MALLEOLUS-HT
583	MENTON-CRINION-LTH
586	MENTON-TO-NASAL-ROOT-DEPRESSION-LTH
588	MENTON-TO-OCCIPUT
592	MENTON-TO-SUBNASALE-LTH
595	MENTON-TO-TOP-OF-HEAD
601	METACARPALE-HT
612	MIDSHOULDER-HT-SIT
616	MINIMUM-FRONTAL-ARC
618	MINIMUM-FRONTAL-BRTH
625	NASAL-ROOT-BRTH
631	NASAL-ROOT-DEPRESSION-TO-OCCIPUT
633	NASAL-ROOT-DEPRESSION-TO-TOP-OF-HEAD
636	NECK-CIRC-BASE
637	NECK-CIRC-BELOW-LARYNX
639	NECK-CIRC-OVER-LARYNX
641	NECK-HT-LATERAL
644	NECK-LTH-ANTERIOR
645	NECK-LTH-POSTERIOR-INION
647	NECK-LTH-POSTERIOR-NUCHALE
648	NECK-TO-BUSTPOINT-LTH

651	NOSE-BRTH
652	NOSE-PROTRUSION
653	OVERHEAD-REACH
654	OVERHEAD-REACH-SIT
655	OVERHEAD-REACH-FOREWARD
656	OVERHEAD-REACH-EXTENDED
657	PALM-LTH
663	PATELLA-BOTTOM-HT
665	PATELLA-MID-HT
666	PATELLA-TOP-HT
670	PENALE-HT
674	PHILTRUM-LTH
678	POPLITEAL-HT-SIT
690	PRONASALE-TO-OCCIPUT
692	PRONASALE-TO-TOP-OF-HEAD
698	RADIALE-STYLION-LTH
702	SAGITTAL-ARC-INION
705	SAGITTAL-ARC-NUCHALE
732	SCYE-CIRC-OVER-ACROMION
735	SCYE-CIRC-OVER-SHOULDER
737	SCYE-DEPTH
743	SHOULDER-BRTH-BOWED
745	SHOULDER-BRTH-REACHING-OVERHEAD
747	SHOULDER-CIRC
751	SHOULDER-ELBOW-LTH
754	SHOULDER-LTH
758	SITTING-HT
760	SITTING-HT-RELAXED
762	SITTING-HT-HELMET
764	SLEEVE-INSEAM-LTH
772	SLEEVE-LTH
797	SLEEVE-OUTSEAM-LTH
799	SPAN
801	SPHYRION-HT
802	SPINE-TO-ELBOW-LTH
803	SPINE-TO-SCYE-LTH
805	STATURE
806	STATURE-CLOTHED
807	STATURE-MAXIMUM
808	STATURE-REPORTED
810	STATURE-SCREENED
814	STOMION-TO-OCCIPUT
815	STOMION-TO-TOP-OF-HEAD
821	STRAP-LTH

825	SUBNASALE-TO-NASAL-ROOT-DEPRESSION
829	SUBNASALE-TO-OCCIPUT
830	SUBNASALE-TO-TOP-OF-HEAD
833	SUBSCAPULAR-SKF
834	SUBSCAPULAR-SKF-II
837	SUBSTERNALE-HT
841	SUPRASTERNALE-HT
844	SUPRAILIAC-SKF
845	SUPRAILIAC-SKF-II
848	SUPRAPATELLA-SKF
850	TENTH-RIB-HT
851	THIGH-CIRC-DISTAL
852	THIGH-CIRC-PROXIMAL
853	THIGH-CIRC-PROXIMAL-SIT
856	THIGH-CLEARANCE
859	THIGH-TO-THIGH-BRTH-SIT
862	THUMB-BRTH
864	THUMB-LTH
867	THUMB-TIP-REACH
869	THUMB-TIP-REACH-EXTENDED
873	TIBIALE-HT
877	TRAGION-HT
880	TRAGION-TO-OCCIPUT
882	TRAGION-TO-TOP-OF-HEAD
888	TRICEPS-SKF
890	TRICEPS-SKF-II
894	TROCHANTERION-HT
900	UMBILICUS-SKF
914	VERIICAL-TRUNK-CIRC-MIDBUTTOCK
916	VERTICAL-TRUNK-CIRC
917	VERTICAL-TRUNK-CIRC-SIT
919	WAIST-BACK-LTH-NATURAL
921	WAIST-BACK-LTH-OMPHALION
924	WAIST-BRTH-NATURAL
928	WAIST-BRTH-OMPHALION
931	WAIST-CIRC-NATURAL
932	WAIST-CIRC-OMPHALION
935	WAIST-CIRC-OMPHALION-SIT
939	WAIST-DEPTH-NATURAL
943	WAIST-DEPTH-OMPHALION
945	WAIST-FRONT-LTH-NATURAL
946	WAIST-FRONT-LTH-OMPHALION
947	WAIST-HIP-LTH
949	WAIST-HT-NATURAL

950	WAIST-HT-OMPHALION
951	WAIST-HT-NATURAL-SIT
952	WAIST-HT-SIT-UMBILICUS
954	WAIST-NATURAL-TO-WAIST-UMBILICUS
957	WEIGHT
958	WEIGHT-CLOTHED
960	WEIGHT-REPORTED
962	WEIGHT-SCREENED
964	WRIST-BRTH-BONE
967	WRIST-CIRC-MINIMUM
970	WRIST-CIRC-STYLION
973	WRIST-HT
974	WRIST-HT-SIT
976	WRIST-TO-CENTER-OF-GRIP-LTH
977	WRIST-TO-INDEX-FINGER-LTH
978	WRIST-TO-THUMBTIP-LTH
979	WRIST-TO-WALL-LTH
980	WRIST-TO-WALL-LTH-EXTENDED
985	XIPHOID-SKF
1001	MARITAL-STATUS-AFW68
1002	COMMAND-AFW68
1003	BLOOD-TYPE
1004	RH-FACTOR
1005	HANDEDNESS
1006	BIRTHPLACE-SUBJECT
1007	BIRTHPLACE-FATHER
1008	BIRTHPLACE-MOTHER
1009	YEAR-OF-BIRTH
1010	AGE-AT-MENARCHE-AFW68
1011	YEAR-MEASURED
1012	OCCUP-AFW68
1013	RACE-AFW68
1014	RANK-AFW68
1015	AERO-RATING-AFM67
1016	AIRCRAFT-AFM67
1017	COMMAND-AFM67
1018	AERO-RATING-AFM65
1019	RELIGION
1020	EDUCATION
1021	MARITAL-STATUS-AFM65
1022	YEAR-ENTERED-AFM65
1023	BOOT-SIZE-LTH-ARM66
1024	BOOT-SIZE-WIDTH-ARM66
1025	RANK-ARM66

1026	PAY-GRADE-ARM66
1027	SERVICE-LTH-ARM66
1028	EDUCATION-ARM66
1029	MARITAL-STATUS-ARM66
1030	BIRTHPLACE-SUBJECT-ARM66
1031	BIRTHPLACE-FATHER-ARM66
1032	BIRTHPLACE-MOTHER-ARM66
1033	RESIDENCE-LONGEST-ARM66
1034	NATL-EXTRACTION-ARM66
1035	TOE-BIGGEST-ARM66
1036	GLASSES-ARM66
1037	RACE-AFM67
1038	RANK-AFM67
1039	RACE-AFM65
1040	RANK-AFM65
1041	MOS-ARW77
1042	RACE-ARW77
1044	SERVICE-LTH-ARW77
1045	RANK-ARW77
1046	BIRTHPLACE-ARW77
1047	AGE-NAVY64
1048	RANK-NAVY64
1049	BIRTHPLACE-NAVY64
1050	AIRCRAFT-NAVY64
1051	LOCATION-NAVY64
1052	RACE-NAVY88
1053	RACE-ARMY88
1054	MIL-COMPONENT-ARMY88
1055	MIL-PERSONNEL-CLASS-ARMY88
1056	GLASSES-ARMY88
1057	RANK-ARMY88
1058	GRADE-ARMY88
1059	BIRTHPLACE-SUBJECT-ARMY88
1060	BIRTHPLACE-MOTHER-ARMY88
1061	BIRTHPLACE-FATHER-ARMY88
1062	MOS-ARMY88
1063	RACE-MINI
1064	RACE-MOTHER-NAVY-MINI
1065	RACE-FATHER-NAVY-MINI
1066	RANK-AF-MINI
1067	BIRTHPLACE-SUBJECT-MINI
1068	BIRTHPLACE-MOTHER-NAVY-MINI
1069	BIRTHPLACE-FATHER-MINI
1070	AIRCRAFT-CURRENT-MINI

1071	AIRCRAFT-MOST-EXP-MINI
1072	BASE-MINI
1073	RANK-NAVY-MINI
1074	MIL-COMPONENT-MINI
1075	NATIONALITY-MINI
1076	NATIONALITY-MOTHER-MINI
1077	NATIONALITY-FATHER-MINI
1078	COMMAND-AF-MINI
1079	SPECIALTY-AF-MINI
1080	SEX-AF-MINI
1501	STRENGTH-CENTER-SIT-45-AVG1
1502	STRENGTH-CENTER-SIT-45-AVG2
1503	STRENGTH-CENTER-SIT-45-PEAK1
1504	STRENGTH-CENTER-SIT-45-PEAK2
1505	STRENGTH-SIDE-SIT-45-AVG1
1506	STRENGTH-SIDE-SIT-45-AVG2
1507	STRENGTH-SIDE-SIT-45-PEAK1
1508	STRENGTH-SIDE-SIT-45-PEAK2
1509	STRENGTH-ONE-HAND-STD-100-AVG1
1510	STRENGTH-ONE-HAND-STD-100-AVG2
1511	STRENGTH-ONE-HAND-STD-100-PEAK1
1512	STRENGTH-ONE-HAND-STD-100-PEAK2
1513	STRENGTH-TWO-HAND-SIT-38-AVG1
1514	STRENGTH-TWO-HAND-SIT-38-AVG2
1515	STRENGTH-TWO-HAND-SIT-38-PEAK1
1516	STRENGTH-TWO-HAND-SIT-38-PEAK2
1517	STRENGTH-TWO-HAND-SIT-50-AVG1
1518	STRENGTH-TWO-HAND-SIT-50-AVG2
1519	STRENGTH-TWO-HAND-SIT-50-PEAK1
1520	STRENGTH-TWO-HAND-SIT-50-PEAK2
1521	STRENGTH-TWO-HAND-STD-38-AVG1
1522	STRENGTH-TWO-HAND-STD-38-AVG2
1523	STRENGTH-TWO-HAND-STD-38-PEAK1
1524	STRENGTH-TWO-HAND-STD-38-PEAK2
1525	STRENGTH-TWO-HAND-STD-50-AVG1
1526	STRENGTH-TWO-HAND-STD-50-AVG2
1527	STRENGTH-TWO-HAND-STD-50-PEAK1
1528	STRENGTH-TWO-HAND-STD-50-PEAK2
1529	STRENGTH-TWO-HAND-STD-100-AVG1
1530	STRENGTH-TWO-HAND-STD-100-AVG2
1531	STRENGTH-TWO-HAND-STD-100-PEAK1
1532	STRENGTH-TWO-HAND-STD-100-PEAK2
1533	STRENGTH-TWO-HAND-STD-150-AVG1
1534	STRENGTH-TWO-HAND-STD-150-AVG2

1535	STRENGTH-TWO-HAND-STD-150-PEAK1
1536	STRENGTH-TWO-HAND-STD-150-PEAK2
1600	LEFT-ALARE-X
1601	LEFT-ALARE-Y
1602	LEFT-ALARE-Z
1603	RIGHT-ALARE-X
1604	RIGHT-ALARE-Y
1605	RIGHT-ALARE-Z
1606	LEFT-CHEILION-X
1607	LEFT-CHEILION-Y
1608	LEFT-CHEILION-Z
1609	RIGHT-CHEILION-X
1610	RIGHT-CHEILION-Y
1611	RIGHT-CHEILION-Z
1612	CRINION-X
1613	CRINION-Y
1614	CRINION-Z
1615	LEFT-ECTOORBITALE-X
1616	LEFT-ECTOORBITALE-Y
1617	LEFT-ECTOORBITALE-Z
1618	RIGHT-ECTOORBITALE-X
1619	RIGHT-ECTOORBITALE-Y
1620	RIGHT-ECTOORBITALE-Z
1621	LEFT-FRONTOTEMPORAL-X
1622	LEFT-FRONTOTEMPORAL-Y
1623	LEFT-FRONTOTEMPORAL-Z
1624	RIGHT-FRONTOTEMPORAL-X
1625	RIGHT-FRONTOTEMPORAL-Y
1626	RIGHT-FRONTOTEMPORAL-Z
1627	GLABELLA-X
1628	GLABELLA-Y
1629	GLABELLA-Z
1630	LEFT-GONION-X
1631	LEFT-GONION-Y
1632	LEFT-GONION-Z
1633	RIGHT-GONION-X
1634	RIGHT-GONION-Y
1635	RIGHT-GONION-Z
1636	LEFT-INFRAORBITALE-X
1637	LEFT-INFRAORBITALE-Y
1638	LEFT-INFRAORBITALE-Z
1639	RIGHT-INFRAORBITALE-X
1640	RIGHT-INFRAORBITALE-Y
1641	RIGHT-INFRAORBITALE-Z

1642	MENTON-X
1643	MENTON-Y
1644	MENTON-Z
1645	PROMENTON-X
1646	PROMENTON-Y
1647	PROMENTON-Z
1648	PRONASALE-X
1649	PRONASALE-Y
1650	PRONASALE-Z
1651	SELLION-X
1652	SELLION-Y
1653	SELLION-Z
1654	STOMION-X
1655	STOMION-Y
1656	STOMION-Z
1657	SUBNASALE-X
1658	SUBNASALE-Y
1659	SUBNASALE-Z
1660	LEFT-TRAGION-X
1661	LEFT-TRAGION-Y
1662	LEFT-TRAGION-Z
1663	RIGHT-TRAGION-X
1664	RIGHT-TRAGION-Y
1665	RIGHT-TRAGION-Z
1666	LEFT-ZYGION-X
1667	LEFT-ZYGION-Y
1668	LEFT-ZYGION-Z
1669	RIGHT-ZYGION-X
1670	RIGHT-ZYGION-Y
1671	RIGHT-ZYGION-Z
1672	LEFT-ZYGOFRONTALE-X
1673	LEFT-ZYGOFRONTALE-Y
1674	LEFT-ZYGOFRONTALE-Z
1675	RIGHT-ZYGOFRONTALE-X
1676	RIGHT-ZYGOFRONTALE-Y
1677	RIGHT-ZYGOFRONTALE-Z
1680	BIGONIAL-BRTH-HDBD
1681	BIINFRAORBITALE-BRTH-HDBD
1682	BIOCULAR-BRTH-HDBD
1683	BITRAGION-BRTH-HDBD
1684	BIZYGOMATIC-BRTH-HDBD
1687	HEAD-BRTH-MAXIMUM-FRONTAL-HDBD
1689	LIP-LTH-HDBD
1691	MENTON-CRINION-LTH-HDBD

1692	MENTON-NASAL-ROOT-DEPRESSION-HDBD
1693	MENTON-TO-SUBNASALE-LTH-HDBD
1695	MINIMUM-FRONTAL-BRTH-HDBD
1697	NOSE-BRTH-HDBD
1698	NOSE-PROTRUSION-HDBD
1699	SUBNASALE-NASAL-ROOT-DEPRESSION-HDBD